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Power Sector Reform and Renewable Energy in the MENA Region: A Study of Interaction between these Two Initiatives in the UAE, Egypt and Morocco

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Power Sector Reform and Renewable Energy in the MENA Region: A Study of Interaction between these Two Initiatives in the UAE, Egypt and Morocco

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Thesis

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Arts and Master of Public Affairs

The University of Texas at Austin

May 2012

Dedication

To my mother, I don’t know where I would be without your support.

Abstract

Power Sector Reform and Renewable Energy in the MENA Region: A Study of Interaction between these Two Initiatives in the UAE, Egypt and Morocco

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The University of Texas at Austin, 2012

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Abstract: In light of the Arab Spring, media professionals and academics have expanded the scope of their focus on the Middle East and North Africa (MENA) region. Yet, relatively little attention has been paid to two powerful forces that could significantly affect its economic and political landscape: power sector reform and renewable energy development initiatives. This paper attempts to outline the history and future of these initiatives in the region by focusing on three MENA region countries, the United Arab Emirates (UAE), with a focus on Abu Dhabi, along with Egypt, and Morocco. Furthermore, this paper analyzes how these two initiatives are affecting one another in the context of the domestic political landscape and economy. The results of this analysis point to three key aspects of power sector reform initiatives affecting domestic renewable energy development: the level of governmental financial supervision, electricity subsidies, and the terms of engagement between the state-run single buyer utility and independent power producers (IPPs).

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Introduction: Linking Renewable Energy and Power Sector Reform in the MENA Region

Introduction

MENA region countries have pursued a wide array of power sector reforms and renewable energy development initiatives over the past two decades. This chapter provides an overview of these initiatives and the motives behind them in the entire Middle East North Africa (MENA) region, as well as a breakdown of common power sector reform models and strategies.

Overview of Renewable Energy Initiatives in the MENA Region

Although the MENA region has become inextricably linked to fossil fuels, the past decade has witnessed a noticeable effort by both oil-producing and non-oil producing countries to develop local renewable energy resources. Indeed, the majority of MENA governments now have dedicated agencies or state-run companies mandated both to promote renewable energy development in-country and to direct the construction and operation of actual projects. Some of these government initiatives, such as the UAE's Masdar Initiative, have received considerable publicity in major press outlets, while others, like Egypt's New and Renewable Energy Authority, remain unknown outside of the energy world.

In terms of realized renewable energy production, the Middle East region alone produced 46,578 Gwh of energy from renewable sources in 2009, with roughly 86% coming from biomass and hydroelectric facilities.[1] Meanwhile, North Africa, Egypt and

[1] International Energy Agency. "Renewables and Waste in Egypt in 2009." International Energy Agency. 2012. http://www.iea.org/stats/renewdata.asp?COUNTRY_CODE=EG (accessed February 10, 2012).,

Morocco produced 1524 Gwh of energy from wind sources alone in the same year.[2] Since 2009, several large-scale wind and solar projects have come online, which will add considerably to this figure.

The size and scope of planned renewable energy projects in the region has also been increasing. In Morocco, the Ouarzazate Concentrated Solar Power Project, scheduled to be commissioned in 2015, is to have a production capacity of 500 MW – this is approaching the average production capacity of a U.S. coal plant (667 MW).[3][4] Meanwhile, Lebanon, a country that relies heavily on energy imports, hopes to more than double domestic renewable energy generation capacity between 2011 and 2014, from 10 MW to 25 MW.[5]

Saudi Arabia, the largest single fossil fuel producer in the world, has engaged the renewable energy market through a different avenue. The Kingdom is working with Germany's Centrotherm Photovoltaics, the world's second largest manufacturer of solar equipment, to construct a $1.1 billion polysilicon manufacturing plant. Saudi Arabia has also begun planning for the construction of the King Abdullah City for Atomic and Renewable Energy, which aims to act as a regional research and development center. It is

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[2] 2009 IEA Renewables Statistics Egypt and Morocco.

[3] African Development Bank Group Project Team. "Environmental and Social Impact Assessment." *African Development Bank Group.* http://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Ouerzazate%20ESIA%20ex%20sum%20version%20ENG%20Oct%202011%20%282%29.pdf (accessed February 10, 2012)., p.2

[4] Energy Information Administration. "Form EIA-860 Database, Annual Electric Generator Report." *http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.* 2005. http://www.eia.doe.gov/cneaf/electricity/page/eia860.html (accessed February 10, 2012).

[5] Hayek, Kamal. "Distributed Renewable Energy Generation in Lebanon and the Net-Metering Opportunity." *Beirut Energy Forum*. September 29, 2011. http://www.beirutenergyforum.com/presentations%202011/Presentation%20Mr.%20K.%20Hayek-%20BEF%202011.pdf (accessed February 10, 2012).

estimated that the Saudi government has pledged $100 billion for the City's construction, to begin in 2013.[6]

Drivers of Renewable Energy Initiatives

The reasons behind the region's dramatic upswing in renewable energy initiatives vary somewhat from country to country; however, when rationalizing their decision to pursue renewable energy, MENA political and business leaders tend to rely on the same arguments. Regardless of their respective energy balances, they all point to the finite and environmentally costly nature of fossil fuels. Saudi Shura Council member, Osama Al Kurdi, has highlighted the Kingdom's excessive electricity and fossil fuel consumption on Saudi national television, openly warning of the dangers of basing the national economy so heavily on the production of a single resource, oil.[7]

The move by MENA politicians towards renewable energy is driven by long-term baseline economics. Oil-rich countries such as Saudi Arabia are seeking to capitalize on rising petroleum prices by directing a greater share of their oil towards international markets, where it will fetch a price many times higher than in the Kingdom; the Saudi government thus hopes to develop renewable sources to compensate for these increased exports on the domestic front. There is also discussion of exporting renewable energy, which could fetch a high price from environment-oriented European governments, as well as provide further compensation under international carbon trading schemes.[8]

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[6] Wam. "Mideast injects Dh661bn in energy projects." *Emirates 24/7*. February 3, 2012. http://www.emirates247.com/business/energy/mideast-injects-dh661bn-in-energy-projects-2012-02-03-1.441032 (accessed February 10, 2012).

[7] SaudiEconomyGateway. "Al Taqa Al Bedeela wa Al Mutajidida." YouTube. September 21, 2011. http://www.youtube.com/watch?v=jD7kNhhON6I (accessed February 10, 2012).

[8] Ibid.

Renewable energy projects are still recognized by the public as frontier technologies, whose successful employment signals a level of social advancement, and thus national pride. MENA politicians are fully aware of this and in many cases are heavily publicizing government-directed renewable energy initiatives domestically in order to cast themselves as champions of modernization and progressivism. The UAE leadership in particular has taken care to orchestrate an expansive public relations campaign promoting its renewable energy initiatives. Their greatest public relations success so far came in 2009, when Abu Dhabi beat out Bonn, Germany to become the site of the International Renewable Energy Agency (IRENA), despite the country's abysmal environmental record.

The state-run media agencies of other governments, such as Algeria, Morocco, and Egypt have also been careful to leak news of proposed projects to global media outlets. The Algeria Presse Service recently announced $60 billion dollars in renewable energy investment by 2030, which was subsequently reported in Bloomberg.[9] More recently, Moroccan Minister of Energy, Mines, Water, and Environment, Amina Benkhadra, interviewed with Macropolis.net to layout and rationalize Morocco's substantial wind and solar energy initiatives.[10]

Overview of Power Sector Reform in MENA Region

The rise in renewable energy initiatives in the MENA region has occurred during a period of significant power sector reform. Since 1990, each of the three countries to be

[9] Razzouk, Nayla. "Algeria Plans $60 Billion in Renewable Energy Investment by 2030, APS Says." Bloomberg. February 9, 2011. http://www.bloomberg.com/news/2011-02-09/algeria-said-to-plan-60-billion-in-renewable-energy-investment-by-2030.html (accessed February 14, 2012).

[10] Macropolis.net. "Morocco Renewable Energy Megaprojects - Marcopolis.net Interview with H.E. Amina Benkhadra." Macropolis.net. July 29, 2011. http://www.youtube.com/watch?v=uHZswlWeJY0 (accessed February 14, 2012).

examined in this case study – the UAE, Morocco, and Egypt – have taken steps to loosen the state's hold over the power sector. In each case, they have sought to unbundle vertically and horizontally-integrated monopolies in order to allow private companies access to local electricity markets, either as producers or distributors.

The UAE initiated the competitive restructuring of its power sector in 1996, with the establishment of the Privatisation Committee for the Water and Electricity Sector. The Committee was exploratory in nature, charged with assessing the options of the UAE's most powerful emirate, Abu Dhabi, for permitting private developers to play a role in stabilizing the country's electricity supply, improving the efficiency of the sector, and creating employment opportunities.[11] The Committee's findings led to the breakup of the monolithic Water and Electricity Department into multiple generation and distribution companies, and a single national grid company. Private producers have since been allowed to participate on the generation side of the electricity supply chain; however, their ownership stakes are limited by federal authorities.[12]

Egypt also began reforming its power sector in the mid-1990s, following much the same strategy of separating a state-run conglomerate into legally distinct entities.[13] Again, the state has retained control of the great majority of generation and distribution activities, while allowing a small number of private developers to build, own, and operate what are essentially pilot power generation projects. Egypt's reform strategy diverges from Abu Dhabi in that it plans allow Egyptian electricity consumers to conclude direct

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[11] Abu Dhabi Regulation and Supervision Bureau. "Annual Report 1999." Abdu Dhabi Regualtion and Supervision Bureau Web site. 1999. http://www.rsb.gov.ae/PDFs/pub9.pdf (accessed November 13, 2011).
[12] ADRSB Web site. Water and Electricity Sector Overview 2008/2009.
[13] Rasazi, Hussein, Vincent Castel, and Emmanuel Nzabanita. "The Arab Republic of Egypt: Power Sector in Brief - 2010." *African Development Bank*. 2010. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/ENERGY%20mpa%20ENG%20Power%20Sector%

bilateral contracts for the purchase of electricity with present and future generation companies.[14]

Morocco's l'Office National de l'Electricité (ONE) began issuing requests for proposal for private generation companies in 1994.[15] However, unlike the UAE and Egypt, Morocco has allowed private developers on both the generation and distribution side to flourish. Indeed, private producers are now responsible for the majority, 68%, of electricity generation in Morocco, and private distribution companies play a significant role in providing electricity to many of the country's urban centers.[16]

The Drivers of Power Sector Reform

In each case, power sector reform has been driven to some extent by a variety of challenges and opportunities. These range from expanding grid access and bringing electricity to rural communities, lowering production costs, improving efficiency and stability of supply, and perhaps most importantly, attracting the necessary capital to improve power sector infrastructure and boost generation to meet surging demand. This follows the conventional economic logic that private producers will be able to operate more efficiently than their public sector counterparts.

Yet the real force behind privatization-oriented power sector reform in developing countries has been multilateral financial institutions, upon which many developing country governments have relied for decades to finance their electricity sectors. The World Bank in particular, which remains a major power project financier in developing

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[14] Ibid.

[15] Energy Sector Management Assistance Program. "Impact of the Credit Crisis on Investments in the Power Sector: the Case of Morocco." Energy Sector Management Assistance Program. January 20, 2011. http://www.esmap.org/esmap/sites/esmap.org/files/Esmap%20Vulnerability%20Morocco%2001%2012.pdf (accessed January 16, 2012).

[16] Ibid.

countries, has stipulated competitive restructuring as a necessary condition for receiving loans from the organization.[17]

Initially, Bank Operational Manual Statement 3.72, which was published in 1978, guided the Bank's lending practices and financial assistance programs for public utilities.[18] Statement 3.72 laid out several policy goals that served as guidelines for sector reform, including "provide power service on the basis of least-cost development programs, (b) strengthen the sector's institutions and improve their efficiency, (c) increase local resource mobilization and catalyze cofinancing [sic], and (d) improve access to electricity by disadvantaged groups."[19]

Roughly a decade later, the Bank found that progress on Bank-financed electrification projects was insufficient. Based on these findings, it adjusted its power sector funding paradigm in order to greater emphasize the necessity of privatization and free markets. Specifically, the five guiding principles to which requesting governments must adhere now include: "transparent regulation, commercialization and corporatization, imports of services, a commitment to reform, and greater private investment."[20] Other multilateral financing institutions have followed suit, namely the International Monetary Fund and several regional development banks such as those serving Asia and Africa.[21]

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[17] Wamukonya, Njeri. "Power sector reform in developing countries: mismatched agendas." Energy Policy, 2003: 1273-1289., p. 1275

[18] The World Bank Group. "Lending for Electric Power in Sub-Saharan Africa." World Bank. 2011. http://lnweb90.worldbank.org/oed/oeddoclib.nsf/DocUNIDViewForJavaSearch/58D5511F6E77E2498525681800610D04 (accessed February 16, 2012).

[19] Ibid.

[20] Ibid.

[21] Njeri., p. 1275; African Development Bank Group. "Nigeria Economic and Power Sector Reform Program." *African Development Bank*. 2009. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Project-and-Operations/Nigeria%20-%20The%20Economic%20and%20Power%20Sector%20Reform%20Program%20(EPSERP).pdf (accessed February 16, 2012).

United Nations Environment Programme expert, Njeri Wamukonya, interestingly points out that the level of commercialization to which developing countries must aspire in order to qualify for multilateral financial assistance has risen along with the demand for electricity. This has been construed by some analysts as a ploy to allow multinational companies – headquartered in countries providing the World Bank with the majority of its capital – access to the developing world's vast commercially untapped electricity markets.[22] The power of multilateral financing institutions derives from the fact that it is exceedingly difficult for many public utilities, starved of cash by the national government, to operate effectively without external assistance.[23]

Finally, there is the issue technology transfers. Proponents of reform argue that deregulation is necessary to allow new technologically distinct entrants access to the electricity market.[24] If the power sector is structured in such a way as to ensure state dominance through contractual arrangements with third parties that limit ownership and profits, private companies will be reluctant to operate in the electricity market. This could be especially disadvantageous for rural communities, which stand to benefit from technological advances in distributed generation.

A Breakdown of Common Power Sector Models and Reform Strategies

As previously stated, power sector reform is almost always liberalizing. Differences between reform models and strategies normally lie in the extent of liberalization, which in turn depends on the power sector's current level of commercialization, as well as prevailing domestic political and economic realities. Broadly, there are four types of

[22] Njeri., p. 1275
[23] Ibid.
[24] Ibid.

power sector models: vertically-integrated monopolies, single buyer, wholesale competition, and retail competition.[25]

Vertically-integrated monopolies are characterized by a single legal entity providing all power-related services – generation, transmission, and distribution – within a defined territory. Monopolies of this sort are self-regulated. Determining the real price of electricity is difficult in this type of environment. Prices paid to generators and for transmission are considered internal transactions and can thus be priced in such a way so as to beautify the utilities financial statements, rather than reflect actual costs.

Per the single buyer model, which prevails in each of the three countries examined in this case study, a single entity – either a vertically integrated unit or a transmission company attached to a larger umbrella organization – enters into power purchase agreements (PPAs) with privately owned and operated independent power producers (IPPs). In most cases, the single buyer offers the IPP a fixed price for the electricity it produces over a 20-25 year period, long enough for the IPP to recover its costs and realize a profit. Prices are transparent to the extent that they are reflected in the PPA.

In wholesale competition scenarios distributors have access to multiple suppliers while the grid functions as the marketplace. Generators and distributors operate as unbundled legally separate entities, are usually privately-owned and operated, and are allowed to contract with one other freely, operating under the auspices of an independent regulator. The actual functioning of a wholesale competition electricity network is extremely complex, relying on nodal pricing, yet subject to a host of other factors not to

[25] Deloitte Touche Tomatsu Emerging Markets, Ltd. "Sustainable Power Sector Reform in Emerging Markets - Financial Issues and Options." USAID. June 18, 2004. http://pdf.usaid.gov/pdf_docs/PNADB308.pdf (accessed February 17, 2012)., p. 4-6

be discussed here. This model exists in several developing and middle-income countries, including Brazil, Argentina, Peru, and the Philippines.[26]

At the far end of the spectrum is the retail competition model, which, unlike the wholesale market model, allows for competition between any unit in the electricity supply chain and any other unit. In this scenario, end-users are not forced to contract with a specific distributor, but can choose from multiple distributors or even contract directly with producers. This model has only recently been deployed in industrialized countries, including parts of the U.S., and only in limited form in a few developing countries.

Most reform strategies involve moving gradually from a more state-controlled power sector to a more liberalized one. In most cases, an exploratory committee of experts will study the current power sector landscape before making recommendations to legislatures who then enshrine those recommendations in law. New institutions are erected and tasked with fulfilling their new legal mandates.

Theorizing on the Effects of Each Model on Renewable Energy Development

The ultimate question this paper seeks to answer is: what is the effect of operating under a specific model or moving from one model to another as these models exist in the MENA region? To answer this question, the political economies, power sector structures, and renewable energy efforts in three countries – the UAE (with a focus on Abu Dhabi), Egypt, and Morocco will be analyzed over the course of the next three chapters. Following this analysis, this paper will attempt to identify common themes regarding the interaction between renewable energy and the power sector – including features of this

[26] Ibid., p.10

interaction specific to the MENA region – before closing with a discussion of the key aspects of power sector reform affecting renewable energy.

Chapter 1: Abu Dhabi and the Masdar Initiative

Introduction

The aim of this chapter is to examine renewable energy development and power sector reform efforts in Abu Dhabi, with an eye towards analyzing the interaction between two. Both renewable energy and power sector initiatives are described in the context of the emirate's political, economic, and energy landscapes. What follows is a brief overview of UAE political and economic history and a description of Abu Dhabi's existing power sector structures followed by an outline of the emirate's current renewable energy initiatives and an assessment of the extent to which existing and future power sector reform efforts could positively or negatively impact the prospect for renewables in the country.

UAE Political and Economic History

Political History

Although Arab tribes, both nomadic and sedentary have coexisted in the southeastern gulf for millennia, the federation known as the United Arab Emirates (UAE) came about only in 1971, after the British negotiated an end to a two centuries old protectorate agreement it had enforced in the region.[27] The idea of a unifying tribal federation was itself the brainchild of a British political resident. [28] Having dealt with the seven tribal fiefdoms known as the Trucial States for roughly a century, the British political resident

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[27] The Official Portal of the United Arab Emirates. *History of the Country and Establishment of the Union*. December 1, 2011. http://www.government.ae/web/guest/uae-history (accessed December 1, 2011).

[28] Davidson, Christopher M. The United Arab Emirates: A Study in Survival. Boulder: Lynne Reinner Publishers, 2005., p. 42.

of the Persian Gulf setup the Trucial Council in the mid-1950s, with the aim of improving regional security. The Council provided a forum for Sheikhs to discuss and decide upon regional issues, as opposed to acting independently. As the British protectorate over the Trucial States came to an end, the political resident became progressively more insistent on the role the council was to play in regional governance, stepping aside as the Council's chair in 1965, so that the Council may select a chair from among member sheikhs.[29]

Resistance to federalism remained upon official termination of the UAE's status as a British protectorate.[30] The rulers of the seven different Emirates, especially the smaller ones, each sought somewhat successfully to maintain a degree of cultural and political autonomy. Aside from foreign policy, defense, and the management of communication networks, each emirate is free to legislate and enforce within its borders as it pleases.

At the federal level, the Supreme Council functions as the highest legislative and executive authority. In the mold of the original Trucial States Council, the Supreme Council counts as its members the leading sheiks of the most dominant tribe of each emirate.[31] Ostensibly, each sheikh is given equal say as a member of the council. In practice, however, Abu Dhabi and Dubai dominate federal level politics, with the President coming from Abu Dhabi and the Prime Minister from Dubai. The President is by far the most powerful political actor in the UAE, followed by the Prime Minister.

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29 Ibid.

30 Ibid., p. 47

31 UAE Cabinet. *The Supreme Council*. 2011. http://www.uaecabinet.ae/English/UAEGovernment/Pages/TheSupremeCouncil.aspx (accessed December 1, 2011).

Democratic participation in the UAE is extremely limited; as of 2006, half of the members of the Federal National Council, a politically weak legislative advisory group, are electable, the other half are appointed by the individual rulers of each emirate.[32] There are licensing and financing rules regarding the establishment of most types of organizations; however, most civil society actors regulate themselves in accordance with the Emirati political climate. This self-regulation stems from what political scientists cite as the "ruling bargain" between the political class and ordinary citizens.[33] The average citizen chooses to refrain from political activism, so long as the state continues to provide a substantial welfare cushion, in the form of subsidized goods, marriage funds, and other economic benefits.

Internationally, the UAE has worked to maintain strong relationships with the West, especially the U.S. and the U.K., while still championing Arab causes, particularly Palestinian statehood. This seemingly contradictory stance extends to the country's social policy as well, where there has been an attempt to promote the UAE as a beacon of innovation and progressivism, while reinforcing traditional Islamic mores. This is clearly an attempt by UAE rulers to maintain the support of both progressive and conservative elements within society, essentially an extension of the ruling bargain.

Economic History

For most of their history, the tribal fiefdoms that today constitute the UAE relied on pearl production, agriculture, fishing, and herding as their primary means of wealth

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32 *Ministry of State for Federal National Council Affairs*. December 1, 2011. http://www.mfnca.ae/?lang=en&m=options&act=index&page=FNC%20Elections&category=34 (accessed December 1, 2011).

33 Davidson., p. 103

generation.[34] It was not until 1962 that the region began exporting oil and not until the 1970s that these exports would rise to become the country's primary source of national income.[35] The great majority of these revenues accrued to Abu Dhabi, which produces roughly 90% of the oil in the UAE.[36] The UAE's founding President Sheikh Zayed Al Nahyan downplayed Abu Dhabi's incentive to hoard its wealth, sharing revenues with other emirate with an eye towards even development and social integration across the seven emirates.

A major step in this direction came in 1974 when the UAE Council of Ministers published a set of countrywide development goals. At the heart of these goals and the impetus behind their promulgation has been the development of the country's human capital, specifically the skills and education of the Emirati citizen. This focus on human development remains an important fixture of the political discourse in the country.

Overall, the UAE economy has grown in dramatic spurts followed by less dramatic recession periods. Periods of rise and fall have been largely linked to oil prices whose changes create economic ripple effects. The Ministry of Planning makes budgetary and economic decisions based on historical oil revenue estimates and when these revenues fail to materialize a variety of planned projects and social services face cuts.[37]

The tremendous reliance on a non-citizen workforce can also be seen as cause for economic instability concerns. While the proliferation of free-trade zones within the country has attracted a variety of multinational companies, few employ Emirati citizens. They rely instead on highly educated western professionals and uneducated south Asian

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34 Al Sadik, Ali Tawfik. "Evolution and Performance of the UAE Economy (1972-1998)." In *The United Arab Emirates: a new perspective*, by Ibrahim Al Abed and Peter Hellyer, 202-230. London: Trident Press, 2001

35 Ibid., p. 208

36 Ibid., p. 203

37 Ibid., p. 209-219

laborers. The government has taken steps to grow the productive capacity of its citizenry in recent years by incentivizing education and the hiring of Emiratis, but employment numbers still skew largely in favor of expatriates.

Political Motives Behind Renewable Energy Development

Abu Dhabi's renewable energy efforts may be seen as a precautionary step towards ensuring the long-term viability of the current political system.[38] The development of new energy sources before the old ones run out will ensure that the government maintains the necessary wealth to provide its citizens with enough of a welfare cushion that they quietly accept the political status quo.

Foreign policy considerations have also figured into Abu Dhabi's renewables push. Abu Dhabi's leaders hope that by transforming the emirate into a renewable energy leader, they will gain international prestige and increase their prospects for developing advantageous bilateral political and economic relationships. The clearest example of this is Abu Dhabi's successful campaign to host the U.N. agency, IRENA. The UAE beat out Germany, despite its poor environmental record, thanks to promises of substantial financial support, in the neighborhood of $135million, for the agency.[39] The prestige associated with the hosting of the UN agency plays well with domestic audiences who will be less likely to agitate for reforms if they believe their government adept at handling foreign affairs.

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38 Davidson., p. 104

39 Krane, Jim. "The Basis of Abu Dhabi's Quest for Renewable Energy and Policies Required to Meet its Goals ." *Dubai School of Government Web site*. September 2010. http://www.dsg.ae/LinkClick.aspx?fileticket=Ln9a0YI9K2g= (accessed November 6, 2011).

In order to appease the domestic polity, the Abu Dhabi government has chosen to ground its newfound commitment to renewable energy in the UAE's Bedouin culture and in the vision of the country's founder, former President Zayed Bin Al Nahyan. The web site of the country's main renewable energy initiative, Masdar, attributes dynamic moves by Abu Dhabi's leaders towards renewable energy and environmentalism to their Bedouin roots, which have instilled in them the importance of sustainability and resource conservation, both key to survival in the desert.[40] Masdar's Chairman, Ahmed Ali Al Sayegh, cites Masdar's renewable energy initiatives as an extension of UAE founder and President Shiekh Zayed Bin Al Nahyan's pioneering environmental efforts in the Gulf region.[41] Yet, the idea of Abu Dhabi's leaders having a historically ingrained sense of environmentalism is ironic given that they preside over and enable the world's tenth highest rate of per capita electricity consumption, much higher if South Asian laborers are factored out.[42]

Economic Motives

In light of its domestic energy shortages and extremely reliance on single individual sources for domestic consumption (natural gas) and export (oil) the UAE's move toward renewable energy can be seen as making long-term economic sense. More interestingly, however, is Abu Dhabi's use of renewable energy as a means to develop its human

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40 Masdar. *About Us: Masdar*. October 25, 2011. http://www.masdar.ae/en/Menu/index.aspx?MenuID=42&CatID=12&mnu=Cat (accessed November 6, 2011).

41 Masdar. *A Message from the Chairman: Masdar*. 2011. http://www.masdar.ae/en/Menu/index.aspx?MenuID=42&CatID=20&mnu=Cat (accessed November 27, 2011).

42 World Bank. *Data: Electric power consumption (kWh per capita)* . 2011. http://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?order=wbapi_data_value_2008+wbapi_data_value+wbapi_data_value-last&sort=asc (accessed November 28, 2011).

capital. The emirate hopes to create an indigenous base of expertise in what is still a frontier technology field.

If the UAE is successful in its attempt to develop renewable research and development capabilities, it could transform itself into a hub for design and possibly manufacturing - given the glut of cheap South Asian labor - of renewable energy technologies. Success, particular on the design side of renewable technologies, could provide huge social and economic windfalls to the UAE. Finally, increasing the UAE's reliance on renewable energy would allow it to redirect its oil and gas away from domestic consumption and towards more profitable activities, such as aluminum production, exporting, and petrochemical manufacturing. [43]

Abu Dhabi's Power Sector Structure and Reform Efforts

Power Sector Structure

The power sector in Abu Dhabi currently follows a single buyer model. The single buyer, the Abu Dhabi Water and Electricity Company (ADWEC), purchases electricity from generation companies, transmits it over the national grid, and sells it to distribution companies, which then deliver directly to customers. The ADWEC enters into long-term power purchase agreements with generation companies, 95% of which are roughly 40% privately-owned and entirely privately operated. The ADWEC also pays generation company fuel costs.

An independent regulator, the Abu Dhabi Regulation and Supervision Bureau (ADRSB), regulates pricing and pricing methods throughout the electricity provision

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[43] El Husseini, Ibrahim, Walid Fayad, Tarek El Sayed, and Daniel Zywietz. "A New Source of Power: The Potential for Renewable Energy in the MENA Region." *Booz & Co. Web site*. 2001. http://www.booz.com/media/file/A_New_Source_of_Power-FINAL.pdf (accessed December 1, 2011).

supply chain, including power purchase agreements (PPAs), which is the price charged to the ADWEC by generation companies, and Bulk Supply Tariffs (BST) – the price paid to the ADWEC by distribution companies.[44] The ADRSB also issues licenses, required by all IPPs, and aims to enforce a variety of safety and performance standards on all electricity sector entities.

Power Sector Reform Efforts

Efforts at power sector reform and the transition from a single vertically-integrated and entirely state-owned entity providing all power related services to the single buyer model which prevails today began in 1996, with the establishment of the Privatisation Committee for the Water and Electricity Sector. The committee was tasked with looking at options for the restructuring and privatization of the sector, with the stated aims of securing supply, improving economic efficiency and quality of service, promoting private investment, creating employment opportunities for UAE nationals, and maximizing revenue from any asset sell-offs.[45]

The Committee's findings led to the passage of Law No (2) Concerning the Regulation of the Water and Electricity Sector, which came into force in 1999.[46] Law No (2) provided for the reorganization of the power sector's singular management entity, the Water and Electricity Department (WED), into separate generation, transmission, and distribution companies, and the introduction of private funds into the sector.[47][48] An

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44 The Government of Abu Dhabi Privatization Committee: Water and Electricity. "Law No (2) Concerning the Regulation of the Water and Electricity Sector." 1998. http://www.rsb.gov.ae/PDFs/law1.pdf (accessed November 13, 2011).

45 Ibid.

46 Ibid.

47 Law No (2) Concerning the Regulation of the Water and Electricity Sector.

48 ADRSB Website Annual Report 1999

umbrella organization, the Abu Dhabi Water and Electricity Authority (ADWEA), was created to house the ADWEC, the transmission company, and the various distribution companies. The WED's assets, liabilities, and employees have since been transferred to one of the new public companies.

The actual introduction of private capital and the divestiture of state assets has only occurred on the generation side. The government has allowed two or more joint venture partners to own up to 40% of a single generation company; however, no single joint venture may on its own possess more than 25% of the emirate's total generation capacity.[49] The Abu Dhabi government maintains its domination over the ostensibly private power generation industry through the ADWEC, which acts as the majority shareholder in all independent power producers (IPPs) with an ownership stake of 60% or greater.[50]

In 1997 the Privatisation Committee issued the first request for proposal (RfP) for private power generation in the country's history; this RfP was for the construction and operation of a combined-cycle natural gas, power and water generation plant situated on Abu Dhabi's coastline called Taweelah A2.[51] CMS Generation, a US power company, won the bid and the administration of the contract was transferred to the ADWEC. A new holding company Emirates CMS was created to own and manage the new plant, with ADWEC maintaining a 60% ownership stake and CMS retaining the other 40%.[52]

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49 ADRSB. "Water and Electricity Sector Overview 2008/2009." *Abu Dhabi Regulation and Supervision Bureau*. http://www.rsb.gov.ae/uploads/Overview20082009.pdf (accessed February 20, 2012).
50 Ibid.
51 Ibid.
52 Ibid.

Responsibility for planning and contracting for new production has since been transferred to the ADWEC.[53]

UAE Energy Economy

In terms of production, the UAE relies exclusively on two sources: crude oil and natural gas. The International Energy Agency's (IEA) energy balance statistics for the UAE put crude oil production at 127,883 thousand tonnes of oil equivalent (ktoe) and natural gas production at 40,917 ktoe.[54] The UAE exports roughly 80% of its crude oil, but is a net importer of natural gas. The Abu Dhabi National Oil Company (ADNOC) is the UAE's domestic oil and gas supplier, while gas imports come from Qatar's offshore North Field.[55]

The great majority of the UAE's electricity production facilities are combined cycle natural gas plants situated on the Abu Dhabi coast. The energy from these plants is used not only to generate end-consumer electricity, but also to power water desalination facilities – a major source of potable water for the country.[56] The ADWEC estimates that 3-3.5% of energy produced in the UAE goes toward desalination.[57]

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53 Ibid.

54 IEA. "2009 Energy Balance for United Arab Emirates." *International Energy Agency*. 2012. http://www.iea.org/stats/balancetable.asp?COUNTRY_CODE=UAE (accessed February 21, 2012).

55 El Saad, Lara. "Averting Crisis: Managing Energy Use in Abu Dhabi ." *Carboun*. October 12, 2011. http://www.carboun.com/energy/averting-crisis-managing-energy-use-in-abu-dhabi/ (accessed February 21, 2012).

56 Abu Dhabi Regulation and Supervision Bureau. "Annual Report 1999." Abdu Dhabi Regualtion and Supervision Bureau Web site. 1999. http://www.rsb.gov.ae/PDFs/pub9.pdf (accessed November 13, 2011).

57 ADRSB. "Water and Electricity Sector Overview 2008/2009.

Subsidies and Consumption Patterns

As of the 2010, energy subsidies in the UAE hovered around $18 billion, or 6% of GDP.[58] The Abu Dhabi government in particular heavily subsidizes electricity, dramatically so for UAE nationals. UAE nationals living in remote areas pay 3fil/kwh for electricity, while those living in cities pay 5fil/kwh.[59] The system marginal price for electricity (i.e. the average price paid by the ADWEC to generators) hovers around 3.23fils/kwh in January and 4.71fils/kwh in August.[60] Subsidies are such that the Abu Dhabi government is passing none of the operational and maintenance costs associated with either transmission or distribution along to UAE consumers in remote areas, and just a fraction of that cost to UAE residents living in urban areas. Such exorbitant subsidy levels have translated into extremely high per capita electricity consumption, 17,296 kwh per capita in 2009.[61] Indeed despite having the world's seventh largest natural gas reserves, the UAE had been experiencing rolling blackouts due to gas shortages prior to the construction of the Dolphin Pipeline.[62]

Political and Economic Motives behind Power Sector Reform

The UAE is a wealthy country and a net donor of foreign assistance by a large margin. There is no evidence that its utility was suffering from the usual set of symptoms common to public utilities in developing countries such as capital scarcity and massive

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58 Krane, Jim. "For renewables to work, first cut energy subsidies." *The National*. January 19, 2012. http://www.thenational.ae/thenationalconversation/comment/for-renewables-to-work-first-cut-energy-subsidies (accessed February 21, 2012).

59 ADRSB Web site. *Customer Tariffs & Charges*. 2011.

60 Abu Dhabi Water and Electricity Company. "Bulk Supply Tariff 2010." *Abu Dhabi Water and Electricity Company*. 2010. http://www.adwec.ae/documents/bst%202010%20leaflet%20to%20discos.pdf (accessed November 25, 2011).

61 IEA. "Selected 2009 Indicators for United Arab Emirates." *International Energy Agency*. 2012. http://www.iea.org/stats/indicators.asp?COUNTRY_CODE=UAE (accessed February 21, 2012).

62 Ibid.

debt. As such, reform efforts have been spurred by the desire for increased economic efficiency, not external pressures from foreign financiers.

Current Efforts at Developing Renewables

All of Abu Dhabi's renewable energy efforts are being executed through the Abu Dhabi Future Energy Company (ADFEC) a.k.a. Masdar. Masdar is a wholly-owned subsidiary of the Mubadala Development Company – Abu Dhabi's primary investment vehicle for socially responsible economic diversification – and figures into Abu Dhabi's broader economic development strategy as outlined in *The Abu Dhabi Economic Vision* 2030.[63]

Unlike the renewable energy development efforts in other MENA countries, Abu Dhabi's highly publicized Masdar Initiative is a multi-faceted effort aimed at transforming the Emirate into a global hub for renewable energy technologies. The emirate is not merely soliciting investment and operational expertise; rather, it is seeking to develop such expertise domestically. Ultimately, the government aims to transform Abu Dhabi into a research and development center for renewables, resulting in knowledge transfers to UAE nationals.

A Renewable Energy Hub for Knowledge Transfers

Two of the Masdar Initatives five "units" or programs are aimed directly at facilitating knowledge transfers: Masdar City and the Masdar Institute. Masdar City, to be situated 17km form downtown Abu Dhabi, seeks to attract the R&D headquarters of the world's

63 Masdar. *About Us: Masdar*. October 25, 2011. http://www.masdar.ae/en/Menu/index.aspx?MenuID=42&CatID=12&mnu=Cat (accessed November 6, 2011).

renewable energy technology companies.[64] To this end, Abu Dhabi authorities have declared Masdar City a "special economic zone," along the lines of neighboring Dubai. These special zoning provisions will provide companies with streamlined services for registering businesses, government relations services, and visa processing, as well as 100% foreign ownership, zero taxes on companies and individuals, zero import tariffs, and unrestricted capital and profit movements.[65] Extending these privileges to renewable energy businesses can also be seen as part of broader power sector reform efforts.

As of 2010, Masdar's stated goal was to attract 1500 companies to operate and invest in Masdar City.[66] This will be difficult as there is little regional demand for renewable technology, with the UAE and other Gulf countries presently relying comfortably on oil and gas to meet their energy demands and offering little in the way of renewable energy promotion strategies and regulatory frameworks.[67] Thus far, companies' interest in Masdar City, which has been lauded by Masdar officials, is grounded primarily in their desire to win contracts to build the city itself.

Masdar City will also house a graduate-level university, the Masdar Institute, whose academic programs center on clean and renewable energy technologies. The Institute was established in cooperation with MIT. According to former MIT Chancellor Phillip Clay, MIT will be working with the Masdar Institute "to develop collaborative research and create indigenous academic programs, to create a strategy for

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64 Masdar. *Masdar City*. 2011. http://masdar.ae/en/Menu/index.aspx?MenuID=48&CatID=27&mnu=Cat (accessed December 1, 2011).

65 Masdar City. *Special Economic Zone*. 2011. http://www.masdarcity.ae/en/38/special-economic-zone/ (accessed December 1, 2011).

66 Reiche, Danyel. "Renewable Energy Policies in the Gulf countries: A case study of the carbon-neutral ''Masdar City'' in Abu Dhabi." *Energy Policy*, 2010: 378–382.

67 Ibid.

commercializing Masdar Institute's research results and to build the institute's organizational and administrative capabilities."[68]

The first class of students began coursework in September 2009. As of October 2010, UAE nationals made up 43% of the Institute's student body. The Institute aims to increase that percentage by creating a pre-Masters program for UAE nationals, which acts as a prep school for the Institute, providing them with a guided academic year, during which they may strengthen their academic credentials.[69]

Masdar Captial, a renewable energy investment portfolio consisting of the Masdar Clean Technology Fund (MCTF) and the DB Masdar Clean Tech Fund (DBMCTF), can also be seen as an attempt to acquire renewable energy expertise. Both funds are managed in conjunction with partner groups.[70] The MTCF is a $250 million fund managed in conjunction with Consensus Business Group, Credit Suisse and Siemens AG, while DBMTCF is a $265 million fund managed jointly with Deutche Bank.[71] Large stakes in renewable technology companies, especially controlling stakes, will help Abu Dhabi acquire proprietary renewable technology and expertise it can use to develop local industries.

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68 "MIT, Abu Dhabi Future Energy Company sign cooperative agreement ." *Techtalk*. 18. Vol. 51. Cambridge: The Massachusetts Institute of Technology, February 28, 2007.
Mubadala. "2010 Annual Report." *Mubadala*. 2010.

69 Masdar Institute. *Masdar Institute launches Pre-Masters program for UAE Nationals* . 2011. http://www.masdar.ac.ae/inc/7/details.php?type=news&id=46 (accessed December 1, 2011).

70 Masdar . *Masdar Capital*. 2011. http://masdar.ae/en/Menu/index.aspx?MenuID=48&CatID=78&mnu=Cat (accessed December 1, 2011).

71 Ibid.

Completed and Planned Renewable Energy Projects

Masdar Power is the unit directly responsible for the development and operation of renewable energy projects. At present, a 10MW photovoltaic (PV) solar plant in Masdar City and 2MW of rooftop solar generation from panels on 11 Abu Dhabi government buildings are the only active renewable energy generation projects in the emirate.[7273] Another solar planted called Shams 1, billed as the largest concentrated solar power (CSP) plant in the world, is currently under construction; its capacity is expected to be around 100MW.[74] In order to encourage investment in Shams 1 and promote the use of solar energy as an electricity source, the Abu Dhabi Ministry of Finance will subsidize the expected high cost of Shams 1 electricity through a "green payment" to ADWEC.[75] The Shams 1 plant is to follow the same ownership structure as Abu Dhabi's other independent water and power producers, with Masdar controlling 60% of the plant and Total S.A. and Abengoa Solar each controlling 20% respectively.[76]

Abu Dhabi also hopes to enter the carbon emissions reduction market. Its vehicle for doing so, Masdar Carbon, hopes to create value by providing carbon emissions

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72 Haider, Hassib. "Solar power for 11 govt buildings in Capital ." *Khaleej Times Online*. September 27, 2011. http://www.khaleejtimes.com/DisplayArticleNew.asp?xfile=/data/theuae/2011/September/theuae_September629.xml&section=theuae (accessed December 1, 2011).

73 Cheyney, Tom. "Masdar City's 10-MW solar PV power plant activated." *PVTech*. June 1, 2009. www.pv-tech.org/news/masdar_citys_10-mw_solar_pv_power_plant_activated (accessed December 1, 2011).

74 Whitmore, Chris. "Shams Power closes financing on 100MW Shams 1 plant." *PVTech*. March 8, 2011. http://www.pv-tech.org/news/shams_power_closes_financing_on_100mw_shams_1_plant (accessed November 29, 2011).

75 Karim Nassif, Jonathan Manley, and Mark Habib. "Q&A: Shams 1 Solar Power Project Financing Shines A Light On Renewable Energy In The Gulf." *Clean Energy Business Council*. March 29, 2011. http://cleanenergybusinesscouncil.com/resources/files/Standard%20%26%20Poors%20on%20Shams%201%20Solar%20Power%20Project.pdf (accessed November 25, 2011).

76 Total. "Shams : The Total's involvement in concentrated solar power ." *Total Web site*. 2011. http://www.total.com/en/our-energies/alternative-energy/solar-energy/total-s-involvement/total-s-involvement-in-concentrated-solar-power-201613.html (accessed December 1, 2011).

reduction restructuring for carbon emitting companies who will then be reimbursed under the United Nations Clean Development Mechanism program.[77] The company claims to be working on a massive carbon capture and storage project that will capture carbon emitted by Emirati heavy industry and subsequently inject it into Abu Dhabi's oil and gas fields for enhanced recovery.

Relative Financial Commitments to Renewable Energy

In terms of financial commitments, Masdar's budget had been set at $22 billion, but has since been decreased to $18.7 billion in the wake of an expected decrease in demand for property in Masdar City.[78] This is roughly 0.8% of the UAE's GDP. The majority of these funds will be going toward the construction of Masdar City; however a portion has already been allocated to Shams 1. Financing for Shams 1, which is coming from 10 major financial institutions including BNP Paribas, the National Bank of Abu Dhabi, Société Générale and the Bank of Tokyo, has closed at $600 million.[79]

The Interaction between Power Sector Reform and Renewable Energy

The Advantages of Reform and the Current Model

Abu Dhabi's single buyer model enables renewable energy development in several ways. Abu Dhabi's current power sector policies offer a stable, relatively low-risk environment

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77 Masdar . *Masdar Carbon*. 2011. http://masdar.ae/en/Menu/index.aspx?MenuID=48&CatID=13&mnu=Cat (accessed December 1, 2011).

78 Drummond, James. "Masdar project cuts $3bn from budget." *Financial Times*. October 11, 2010. http://cachef.ft.com/cms/s/0/953d21ee-d552-11df-8e86-00144feabdc0.html#axzz1f8oGduzJ (accessed November 29, 2011).

79 Masdar. *Media Centre: Masdar*. October 25, 2011. http://www.masdar.ae/en/MediaArticle/index.aspx?News_Type=PR&CatID=64&MenuID=55&mnu=Pri (accessed November 6, 2011).

for the attraction of renewable energy investment funds and the development of renewable sources. The government's extreme economic power and authoritarian political system enables it to easily direct economic resources towards socially beneficial projects. The 60:40 ownership ratio offered by the ADWEC effectively acts as a loan guarantee; ADWEC, whose capital resources being tied to the Abu Dhabi treasury are virtually unlimited, will no doubt be willing to shoulder would-be visceral financial threats to renewables projects. Furthermore, the strength of Abu Dhabi's credit rating – AA – makes whatever financial guarantees it offers all the more valuable.

The ADWEC's use of long-term power purchase agreements (PPAs), which offer generation companies full-cost recovery pricing for 20 year periods, exemplifies the emirate's willingness to shoulder risk. These PPAs provide renewable energy developers with an economic foundation. Solar and wind construction and operation outfits with PPAs in hand are more able to secure financing from private investors; they signal to investors that the government is willing to bare the potential economic costs associated with the project.

The 60:40 model, combined with ADWEC's ownership of Abu Dhabi Transmission and Despatch Company (TRANSCO), ensures would be renewable developers access to the national grid upon completion of their projects. The same cannot be said for renewable developers in unregulated markets, such as Texas where Wind Farms constructed in the West are having difficulty reaching their customer base in the east due to lack of grid access and political opposition to the building of necessary

transmission lines.[80] The government has also shown a great deal of flexibility regarding the operating procedures of private partners, allowing them to subcontract as necessary.[81]

Finally, there is no mention of a sunset clause regarding the contractual relationship between the ADWEC and IPPs. In many cases, IPPs fear sunset clauses. Power projects often require large upfront costs and take many years to become profitable. This economic reality has driven populist moves to nationalize private power companies in many developed and developing countries over the past century. Under Abu Dhabi's system, IPPs need not fear future expropriations at the height of their profitability. For renewables, this could help drive costly technological upgrades that whose costs would only be recovered in the longer term.

Disadvantages

On the other hand, a single buyer model and limited ownership mean there is little opportunity for firms to maximize profits through competitive business practices in the same way that they could in Texas, where there exists the possibility for complete private ownership and direct contracting with end-users.[82] Firms' profit-maximizing and efficiency calculations within the context of the Abu Dhabi power sector are likely to be vastly different than those same calculations in the context of a truly competitive market. For example, regardless of whether or not firms invest sizable amounts of capital in a plant, the obstacle to full ownership and profit-maximization on capital investments remains. Just as the absence of a sunset clause could help drive capital investment

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80 State Energy Conservation Office. "Wind Energy Transmission." *State Energy Conservation Office Web site*. www.seco.cpa.state.tx.us/re_wind-transmission.htm (accessed December 1, 2011).

82 Texas Electric Choice. Electricity Basics. 2011. http://www.powertochoose.org/_content/_about/electricity_basics.asp (accessed December 2, 2011).

upgrades in renewable energy projects, obstacles to full-ownership could detract from them.

Continuing with this logic, allowing firms the right to own new plants, renewable or otherwise, would necessitate a variety of other structural reforms that would greatly diminish the Abu Dhabi government's level of control over the power sector, and in turn diminish its ability to dispense key gifts to its citizens in the form of free water and extremely cheap electricity. If firms were given full ownership, then they would surely demand fair access to consumers; however, it would be difficult for the Abu Dhabi government to convince them that fair access was being provided, so as long as some generation companies, along with transmission and distribution networks, are owned by the same umbrella organization. ADWEC could easily cross-subsidize generation at some of its plants by offering those plants cheaper access to the grid.

Were the Abu Dhabi government to retain its vertically-integrated monopoly, it would have to be upfront with companies regarding the accounting practices of each ADWEA subsidiary. Currently, ADWEC publishes the bulk supply tariff, which is the price of electricity sold to distribution companies.[83] Yet, the price of electricity detailed in ADWEC's purchase power agreements with IPPs remains unpublished.

Conclusion

Abu Dhabi's approach to renewable energy is unique among MENA region countries as are the drivers behind its efforts at power sector reform. The primary reason for this relates to the emirate's economic position as a wealthy country with a highly developed

83 Abu Dhabi Water and Electricity Company. "Bulk Supply Tariff 2010." *Abu Dhabi Water and Electricity Company*. 2010. http://www.adwec.ae/documents/bst%202010%20leaflet%20to%20discos.pdf (accessed November 25, 2011).

power sector infrastructure and near complete territorial electrification. The country's high level of development and traditional authoritarian political structures have created a unique set of incentives, challenges and opportunities for Abu Dhabi's leaders.

While other MENA countries see both renewable energy and power sector reform as a means to achieve more acceptable living standards, the view in Abu Dhabi seems be more focused on using renewable energy as a means to promote its international standing and influence. Indeed, the majority of government funds dedicated to renewable energy are being spent either on the construction of Masdar City or on investments in research centers and companies developing projects in other parts of the world. In a sense, Abu Dhabi has moved to provide renewable energy services to foreign populations before having developed its own internal renewable energy capacity. Yet, while seemingly ironic, this strategy fits with the country's plan to develop renewable technology expertise.

The country's power sector reform efforts and present structure may offer just the right kind of environment to allow renewable energy companies an opportunity to carve out a small, but growing market niche in the country. Full privatization of the sector would surely undermine the development of renewables, regardless of whether or not feed-in tariffs were offered. The government is able to mitigate risks associated with renewable energy projects in a myriad of ways that private sector entities never could or would. Perhaps as the price of oil continues to rise and domestic supplies diminish, the emirate will redouble its efforts to develop renewable energy capacity locally. At this point, the technology may be commercially viable to the extent that privatization would serve only to drive down prices as opposed to price out desired sources. Abu Dhabi's renewable energy initiatives, though ridiculed by many critics as being more stylish than substantive, may actually be quite sensible.

Chapter 2: Egypt, the National Renewable Energy Agency, and the Role of Bilateral Assistance

Introduction

Despite gradual steps toward engagement with IPPs, the Egyptian government has chosen to retain control over renewable energy projects for financial reasons. This presents both challenges and opportunities. Furthermore, the recent overthrow of President Mubarak has drastically changed the country's political landscape and could have powerful implications for the future of renewable energy in the country. This chapter examines the implications of Egypt's reliance on bilateral aid funneled through the National Renewable Energy Agency on the country's renewable energy prospects, as well as the potential effects of the recent revolution.

Egyptian Political Economy in Brief

Unlike the UAE, the Egyptian government's official website does not contain a page summarizing the formation and development of modern Egypt. Perhaps this is because it would be difficult to trace the origins of the state through several millennia – as well as a politically eventful 20th century – in one page. Indeed, Egyptian cultural history is long and complex. Most studies of modern Egypt begin with the overthrow of King Farouk by the Free Officers Movement. Given the power concentrated in the hands of each of Egypt's rulers during the post-Farouk period, along with the cults of personality each ruler inspired, Egypt's republican history most readily lends itself to delineation by president.

Gamal Abd Al Nasser

Nasser's policies centered on state-directed industrialization projects. The state's capstone project, which would come to symbolize the resurgence and industrialization of Egypt, was the Aswan High Dam, now known as Aswan 1. The goal of the high dam was both to provide hydroelectric power and to increase the amount of arable land along the Nile through irrigation.[84] The U.S. and the World Bank had promised to act as the primary financers for the High Dam's Construction; however, in light of Nasser's decision to remain neutral during the Cold War, U.S. Secretary of State John Foster Dulles abruptly and publicly pulled funding from the project. This in turn led to Nasser's

[84] Ibid., p. 133

decision to nationalize the Suez Canal and the accompanying political crisis. By the end of 1957 Nasser had nationalized all British and French assets within the country, including tobacco, cement, pharmaceutical, and phosphate industries.[85]

Nasser also initiated expansive land reforms. In his quest to politically and economically weaken Egypt's powerful landowning class, Nasser passed Law No. 178, which limited individual landownership to 200 feddans or roughly 208 acres. Prior to Nasser's initiative, the majority of Egypt's land was held by an extremely small minority of Egyptians.[86] Nasser's attempts at creating more equitable economic circumstances for ordinary Egyptians cemented his popularity among the masses.

Anwar Al Sadat

Nasser's successor, Anwar Al Sadat, who came to power in 1970, turned Egypt away from the Soviet Union, reengaged with the U.S. and other Western powers, and embraced Western capitalism through his policy of "*Al Infitah*" or openness. After the perceived Egyptian military success of the 1973 October War, Sadat felt politically empowered to break with Nasser's legacy and felt that guided economic openness would bring prosperity to Egypt.

Unfortunately, Sadat's economic initiatives did little to provide ordinary Egyptians with the possibility of generating capital.[87] Instead, government officials and

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85 Aburish, Saïd K. *Nasser: The Last Arab*. New York: St. Martin's Press, 2004., p.138

86 Osman, Tarek. *Egypt on the Brink*. New Haven: Yale University Press, 2010., p.45

87 Osman, Tarek. *Egypt on the Brink*. New Haven: Yale University Press, 2010., p. 118

the politically well-connected were the major beneficiaries of massive state asset sell-offs that left Egyptians who relied on the services provided through those assets much worse off.[88] Economic power remained increasingly concentrated and directed by the regime and its apologists. Meanwhile, the multitude of Egyptians that benefited from Nasser's state welfare programs were suddenly disenfranchised. These economic moves combined with Sadat's embrace of Israel and the Camp David accords roused many political foes.

Hosni Mubarak

While Sadat promulgated a policy of contained economic openness designed for the regime's benefit, Mubarak executed a similar strategy in the political sphere. He relaxed restrictions on the press, allowed for civil society associations to flourish, and provided political parties other than the ruling National Democratic Party with limited avenues for political participation.[89] In this way, Mubarak aimed to appease the dangerous political opponents amassed by his predecessor. Mubarak hoped to rein in Sadat's Infitah and heavily subsidized state infrastructure projects. However, in the early 1990s Egypt's economic fortunes took a downturn in the wake of falling oil prices and the Egyptian government was forced to accept conditional loans from the International Monetary Fund (IMF), which prescribed deep cuts in a variety of state programs.[90]

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[88] Ibid., p. 118-119
[89] Ibid., p. 166
[90] Ibid., p. 167

Internationally, Mubarak largely avoided taking a leadership role in regional affairs as did both Nasser and Sadat. Since the Persian Gulf War in 1991, Egypt has generally followed the lead of the Saudis on regional matters, supporting the initial American campaign against Saddam and championing Saudi-backed politicians in neighboring Lebanon.[91] Mubarak, like his Saudi counterparts, has sought to carve out a critical role for Egypt in promoting America's agenda in the region.

Mohamed Hussein Tantawi

At the time of writing, Tantawi had been in power for just over a year. Since his ascension, mass protests have continued unabated and parliamentary elections have occurred. The Muslim Brotherhood and the salafist party Al-Nour now control overwhelming majority of seats in Egypt's legislature and have agreed to form a governing coalition. Meanwhile, Presidential elections are scheduled to be held by the end of June 2012.

Political and Economic Motives for Developing Renewables

The rationale behind renewable energy initiatives in Egypt is more straightforward than in Abu Dhabi. Egypt faces regular blackouts, which strike even the most upscale urban neighborhoods. Chronic gasoline shortages and long lines at the pump also occur on a

[91] Ibid., p. 172

semi-frequent basis. Renewable energy is simply another supply option that can help the government meet surging demand and provide a host of other positive externalities.

Egypt's economic position allows it to benefit significantly from development assistance offered by multilateral financing institutions. To date, nearly all of Egypt's renewable energy projects have been spurred by both bilateral and multilateral grants and below market rate loans that would likely be unavailable to the government were it focused solely on fossil fuel resources.

On the political side, all that can be said at the time of writing is that Egypt's political future remains so uncertain that any assessments as to how the ruling political class sees renewable energy are baseless. The established political order whereby a small cadre of ex-military members from the National Democratic Party decide upon all major domestic and international issues has been upended. A number of political factions are vying for power. The Islamists are in the lead, but it is unclear whether or not the military will be willing to relinquish control.

That being said, the basic relationship between the government, its constituents, and its foreign partners is in flux. A whole host of factors – chiefly the political positions of the Egyptian economic elite – will affect the energy mix. Furthermore, Egypt's access to Western aid could vary greatly depending on the stance of the new government and as its stands right now, less aid will almost certainly mean less room renewable energy development.

The Power Sector in Egypt

Structure and Governance

In terms of governance, the Egyptian electricity sector can be separated into two parts: oil and gas activities, both upstream and downstream, controlled by the Ministry of Petroleum, and electricity generation, transmission, and distribution, controlled by the Ministry of Electricity and Energy (MOEE).[92] The activities of the two ministries, such as the pricing of petroleum products and electricity, are coordinated within the Council of Ministers, which operates through specific ministerial committees. In 2006, the Egyptian Prime Minister Ahmed Nazif created an overarching body, the Supreme Council for Energy, to oversee broad energy policy initiatives in terms of legislative and institutional frameworks and investment programs.[93]

The MOEE owns all newly created power sector state-entities through the umbrella company, the Egyptian Electricity Holding Company (EEHC). The EEHC in turn contains 16 subsidiaries including: "one hydropower…five thermal electricity generation companies; nine electricity distribution companies; and a transmission-and-dispatch company."[94] The EEHC is responsible for managing the sector's finances; however, there are six separate authorities, which report directly to the MOEE including: the Rural Electrification Authority, the Hydropower Projects Executive Authority, the

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92 Rasazi, Hussein, Vincent Castel, and Emmanuel Nzabanita. "The Arab Republic of Egypt: Power Sector in Brief - 2010." *African Development Bank*. 2010. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/ENERGY%20mpa%20ENG%20Power%20Sector%20Emer.pdf (accessed December 27, 2011)., p. 11 (Subsequently referred to as AfDB Report)

93 Ibid., p.11

94 Ibid.

New and Renewable Energy Authority, Atomic Energy Authority, Nuclear Power Plants Authority, and Nuclear Material Authority.[95] These authorities are responsible for research, as well as the planning and execution of area-specific projects. With the exception of renewable energy, completed projects are transferred to the EEHC upon completion. Renewable energy projects, mostly wind farms, are being retained under the New and Renewable Energy Authority (NREA).

The Egyptian Electric Utility and Consumer Protection Agency (EEUCPRA) acts as an independent regulatory body. Established in 2002, the EEUCPRA's current set of prerogatives includes licensing operating companies, presumably private ones, establishing performance benchmarks, and of course promoting competition.[96] If the New Electricity Law is passed, the EEUCPRA will be empowered to set electricity tariffs.[97] Until the law is passed, the EEUCPRA is responsible to regulate only one buyer, the Egyptian Electricity Transmission Company (EETC) – the sole buyer of electricity in Egypt, which sells electricity directly to distribution companies and to large customers.

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95 Ibid.

96 Ibid.

97 Salmawy, Hafez El. "Egyptian Power Sector Reform and New Electricity Law." Euro-Mediterranean Energy Market Integration Project. http://www.medemip.eu/CMS/ImageUpload/Mashrek%20presentation%20-%20Hazem%20El%20Salmawy.pdf (accessed December 26, 2011).

Power Sector Reform

Electricity reforms in Egypt occurred within roughly the same time frame as those in Abu Dhabi, with the unbundling of the Egyptian Electricity Authority taking place in 2000.[98] This unbundling was done both vertically, through the separation of distribution, generation, and supply, and horizontally, through the creation of multiple companies operating within each part of the supply chain.

Most recently, Egypt's chief executive body, the Cabinet of Egypt, professed its commitment to a fully competitive power sector by endorsing the 2008 New Electricity Law, which was on track to be submitted to Parliament in 2011.[99] The law "envisages divestiture of up to 49% of each [Egyptian power] company," all of which are currently state-owned.[100] The law will allow eligible consumers to purchase electricity directly from producers through bilateral contracts. There will also be a Transmission System Operator responsible for fulfilling bilateral contracts between consumers and producers.

Thus far, the only means through which IPPs can operate in Egypt is through the BOOT (Build, Own, Operate, Transfer) program.[101] The BOOT program, allows IPPs to build, own, and operate generation plants for a predetermined period, usually long enough to ensure a reasonable rate of return on capital investments, before transferring ownership to the EEHC. As of 2011, there are two independent power producers operating generation plants in Egypt: U.S.-based InterGen (a joint venture of Bechtel

98 AfDB Report., p. 11
99 Ibid., p. 8
100 Ibid.
101 Ibid., p.12

Enterprises and Shell Generating Ltd.) and Tanjong's Powertek.[102] InterGen's plants produce a total of 650MW, while Powertek's capacity hovers around 1400MW. As of 2011 total installed capacity is roughly 24,000MW; therefore, private companies are responsible for a mere 8.5% of total electricity generation in Egypt.[103]

Energy and Electricity Subsidies

Egypt heavily subsidizes a variety of petroleum and natural gas products, which are calculated by the government as the losses of the Egyptian General Petroleum Company.[104] As per contractual agreements, the oil extraction companies are entitled to a share of the oil they extract. The Egyptian government then repurchases this oil and sells it at dramatically reduced prices to consumers; for example, liquefied petroleum gas is bought on average for 1858 LE per ton from partner companies and sold domestically for 200 LE per ton.[105]

Unlike Abu Dhabi, the Egyptian government does not heavily subsidize electricity directly. Instead, prices are kept low through natural gas subsidies, which if eliminated would raise electricity prices by about 10.3%.[106] The level of subsidies in the

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102 Ibid.; Mbendi. "Electrical Power in Egypt - Overview." Mbendi: Information Services. November 22, 2011. http://www.mbendi.com/indy/powr/af/eg/p0005.htm (accessed December 26, 2011).

103 Rasazi, Hussein, Vincent Castel, and Emmanuel Nzabanita.

104 Poortman, Christian J., Mustapha K. Nabli, Emmanuel E. Mbi, Miria A. Pigato, and Radwan A. Shaban. "Egypt - Towards a More Effective Social Policy: Subsidies and Social Safety Net." *World Bank*. December 16, 2005. http://siteresources.worldbank.org/INTPSIA/Resources/490023-1171551075650/Egypt_PSIA_121605.pdf (accessed January 26, 2012)., p. 42

105 Ibid.

106 Ibid., p.36

sector does not approach that of Abu Dhabi and the government has been on track to raise electricity prices by roughly 5% annually for the next several years since 2005.

A Long History of Renewable Energy Development

Egypt has a relatively long history of meeting a portion of its energy needs through renewable sources using modern technologies, beginning in 1960 with the construction of Aswan 1 Dam, followed by the completion of Aswan 2 in 1985.[107] In 1986, it created a government agency, the NREA, dedicated to the promotion of renewable energy and the management of renewable energy projects.[108]

The NREA's staff hovers around 750 and consists of many well-qualified renewable energy professionals including engineers, technicians, and economists, as well as administrative staff.[109] Surprisingly, the organization receives no money through state appropriations, but is instead expected to generate enough revenue to survive by providing studies for third parties, conducting tests, issuing certificates, and performing other services.[110] In reality, the revenue produced from these operations is consistently

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107 Egyptian Ministry of Energy and Electricity. "Aswan (1,2) Electric Hydro Power Plant." *Egyptian Ministry of Energy and Electricity*. 2010. http://www.moee.gov.eg/english/elshabaka/Aswan%20Dam%20%281,2%29.htm (accessed December 26, 2011).

108 Egyptian New and Renewable Energy Authority. *NREA Homepage*. http://www.nrea.gov.eg/english1.html (accessed 26 December, 2011).

109 Mostert, Wolfgang. "Feasibility Report: Zafarana 3, 120 MW Windfarm ." *Wolfgang Mostert's personal website*. May 2004. http://www.mostert.dk/pdf/Zafarana%203%20feasibility.pdf (accessed January 26, 2012)., p. 17

110 Ibid.

insufficient to cover annual costs, thus the NREA survives largely through loans from the National Investment Bank of Egypt, which are not expected to be repaid.[111]

A Renewable Energy Development Strategy

The NREA's mandate to pursue wind and solar projects figures into the Egyptian government's national diversification strategy. The strategy, which was approved on February 2008, aims to have 20% of Egyptian electricity consumption come from renewable sources by 2020.[112] It also specifies the percentage to come from each source; wind energy is to represent 12% of total generation or 7200 MW, while 8% is to come from hydro power and solar.

The strategy envisions a leading role for the private sector in the development of Egypt's renewable energy capacity, laying out a number of incentives meant to encourage private sector participation. First among these is the EETC's soliciting of bids from private companies to build, own, and operate wind farms in Egypt. As an incentive, the EETC is offering potential renewable energy investors a long-term power purchase agreement of between 20 and 25 years. Electricity from wind farms and solar plants will be bought at above market rates and paid in foreign currency to ensure the economic

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111 Ibid.

112 World Bank. "Egypt: Renewable Energy and Clean Transport Are Cornerstones of Low Carbon Growth." *World Bank: News and Broadcast*. June 5, 2009. http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:22203619~pagePK:64257043~piPK:437376~theSitePK:4607,00.html (accessed January 24, 2012).

viability of the projects.[113] Meanwhile, renewable energy equipment imports will be exempt from customs duties; however, in order boost Egyptian manufacturing, projects making use of local components will be privileged over those relying exclusively on foreign parts and labor.[114]

The Egyptian government is also taking steps to ensure land availability for large scale wind farms and solar projects. On May 26, 2010, the Cabinet of Egypt approved the allocation of 7600 km^2 of desert land for the construction of future projects.[115] Project investors will pay for land leases with a percentage of the energy generated annually from their projects.

R & D Initiatives

The NREA has established facilities for research, development, and training along the lines of Abu Dhabi's Masdar Institute. On the R&D side, the Center for Renewable Energy Research and Testing, created in collaboration with the European Union and the Government of Italy, is acting as an equipment and appliance testing facility within Egypt's borders. Meanwhile, the NREA's training centers provide general as well as technical knowledge to students in renewable energy and energy efficiency.[116] However,

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113 Egyptian General Authority for Investment . "Invest in Egypt: Renewable Energy." *Egyptian General Authority for Investment* . 2010. http://www.gafinet.org/English/SectorsValuePreposition/Renewable%20Energy%20value%20proposition-2010.pdf (accessed January 25, 2012).

114 Aboulnasr.

115 AfDB Report., p. 22

116 Egyptian New and Renewable Energy Authority. "Activities in the Field of Training and Promotion." *New and Renewable Energy Authority*. 2010. http://www.nrea.gov.eg/english1.html (accessed January 26, 2012).

unlike Masdar, the NREA provides no detail regarding the qualifications of either instructors or the applicants on its website, nor does it provide any specific information regarding material covered in its training programs.

Perhaps most importantly, the NREA has laid the ground work for future wind energy investment by preparing a comprehensive wind energy atlas for Egypt. The atlas was prepared between 1998 and 2005 by the NREA, the Egyptian Meteorological Society, and the Danish Risø National Laboratory, and offers detailed statistics regarding the country's wind energy potential.[117] According to the Atlas, the Gulf of Suez and Gulf of Aqaba regions offer the greatest potential energy output. Indeed the Gulf of Suez is one of the world's most attractive locations for wind energy due to consistently high wind speeds, "proximity to load centers and transmission infrastructure, and availability of large uninhabited desert area."[118]

Completed and Planned Projects

Egypt's first non-hydropower renewable energy project was the wind farm at Ras Gharib. The monolithic Egyptian Electricity Authority, with assistance from USAID, completed the 250 kw project in 1988.[119] A short while later, a second much larger wind farm was installed in phases from 1992 to 1996 with the help of Germany. This second farm is

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—. *NREA Homepage*. http://www.nrea.gov.eg/english1.html (accessed 26 December, 2011).

117 *Wind Atlases of the World*. September 12, 2011. http://www.windatlas.dk/egypt/download/wind%20atlas%20for%20egypt%20paper%20(menarec3).pdf (accessed January 25, 2012).

118 AfDB Report., p. 21

119 Aboulnasr, Sherif. "Financing Large Scale Wind Farms in Developing Countries: Zafarana Wind Farm ." *United Nations Environment Programme*. April 2006. http://www.unep.fr/energy/activities/eca/pdf/WS5/WS5-Sherif.pdf (accessed January 6, 2012).

connected to the local Hurghada city grid on the Red Sea coast and functions as Egypt's research and development center for wind energy.[120]

Egypt's largest non-hydropower renewable energy production facility by far is the Zafarana wind farm. The wind farm is situated along the Gulf of Suez and has been under construction in phases since 1997. It consists of eight units, each of which has followed a different financing scheme and involved a different set of project developers. The eighth and possibly final unit has a capacity of 120MW and was completed in 2010, bringing total production capacity of the farm to around 545MW.[121]

On the solar front, one major project, El Kuraymat, came online in July 2012, while another, Kom Ombo, is still several years from completion. El Kuraymat, which is about 100km south of Cairo combines fossil fuel and renewable energy technology in one facility; a 110 MW natural gas plant operates at night, while a 150 MW solar thermal field operates during the day. The plant was constructed by Spanish energy group Iberdola under contract from the NREA, which was in turn supported financially by the World Bank and the Japan International Cooperation Agency.[122] The second solar project, Kom Ombo, is a 100 MW plant to be built over a five year period between 2012

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120 Ibid.

121 NREA. "Annual Report - 2010." *Egyptian New and Renewable Energy Authority* . 2010. http://www.nrea.gov.eg/annual%20report/annual2010En.pdf (accessed January 25, 2012).

122 Laylin, T. (2011, November 7). Exclusive Pics: Kuraymat – Egypt's First Solar-Thermal Plant. Retrieved February 9, 2012, from Green Prophet: http://www.greenprophet.com/2011/11/exclusive-pics-kuraymat-egypt/

and 2017, with financing coming from the World Bank and the African Development Bank, and UN's Clean Development Mechanism.[123]

Power Sector Reform and Renewable Energy

A look at the financing of the Egypt's largest non-hydropower renewable energy project, the Zafarana Wind Farm, offers considerable insight into the roles of the public and private sectors in developing Egypt's renewable energy capacity so far. Zafarana is entirely state-owned, a decision that was made for economic reasons.[124] Sherif Aboulnasr, Chairman of the Egyptian National Committee of the World Energy Council, points out that the incentives the Egyptian government would have had to offer companies to develop a project as large as Zafarana would have had to outweigh the costly and restrictive financing those companies would have faced from investors.

As a developing country government agency, the NREA can borrow at below market rates and solicit grants and other forms of international economic assistance unavailable to private companies. The agency also requires a very low return on equity for projects under its direction, faces no debt service coverage ratio from lenders -usually high given perceived wind technology risks - and enjoys longer debt repayment periods.[125]

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123 Young, Tom. "Egypt plans 100MW solar power plant." *The Guardian*. July 12, 2010. http://www.guardian.co.uk/environment/2010/jul/12/egypt-solar-power (accessed January 25, 2012).
124 Aboulnasr.
125 Ibid.

Full NREA ownership has also simplified the development of Zafarana on the domestic front. Negotiations for access rights and the building of transmission lines with the national grid company are streamlined and local stakeholders, such as on-site banks, landowners, and local suppliers of equipment and other goods, have given their consent that they will assist in the project's development as needed.[126]

A Closer Look at Zafarana

The NREA relied entirely on a grant from the Ministry of Foreign Affairs of Denmark to finance the pilot unit of the Zafarana wind farm, Zafarana 1, while each of the subsequent seven units were financed through a mixture of grants, soft loans, mixed credit, and commercial loans. As the total project nears completion, the NREA has had to rely more heavily on mixed credit and commercial loans; however, the interest rates are still lower than those available to private developers working on similar projects.[127]

A feasibility report for the 120 MW Zafarana 3 wind farm prepared by independent Danish consultant Wolfgang Mostert provides a more detailed picture of the financial and logistical considerations involved in developing a large-scale wind project in Egypt. A table in the report provides a concise summary of the financing for the project as follows:

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[126] Ibid.
[127] Ibid.

Table 1.1: Composition of Project Finance for Zafarana 3 Wind Farm[128]

Composition of Project Finance	**Egyptian Pounds (EGP)**	**in % of total**
NREA equity	19,206,671	2%
mixed credit loan	740,091,600	84%
DANIDA grant to interest during construction, principal	22,202,748	3%
loan from NIB to NREA	108,837,805	12%

A mixed credit loan from the Danish International Development Agency (DANIDA) is the major source of funding for the project. The loan is being distributed through an on-site private bank with the NREA covering exchange rate risk.[129]

Conclusion

While Egypt has moved slowly towards enhancing the private sector's role in fossil fuel power generation, it has favored bilateral assistance in the form of grants and low interest rate loans funneled through the NREA for the development of its renewable energy sources. Indeed, the government's ability to secure financing on such favorable terms has, in part, driven interest in renewable energy. The most recently constructed Zafarana

[128] Report: Zafarana 3, 120 MW Windfarm., p. 20
[129] Ibid., p.18

unit, Zafarana 8, was financed entirely through a mixed credit loan on which DANIDA has agreed to pay the interest.

However, the question remains: for how much longer can Egypt expect to receive such favorable financing terms for its renewables projects? Wolfgang Mostert, an independent energy economist and consultant who prepared a feasibility study for DANIDA regarding the construction of Zafarana 3, believes there is an implicit understanding between Egypt and its foreign development partners that external subsidy support for Egypt's renewables sector is temporary and will be phased out as the baseline economics for wind farms improve. Yet, he also points out that for private developers to become involved, there must be a strong financing and regulatory framework.[130]

Chapter 3: Morocco, ONE, and Euro-Mediterranean Energy Integration Project

Introduction

Despite an authoritative monarch, the Moroccan government has been willing to relinquish considerable control over traditionally state-dominated sectors, and the power

[130] Mostert., p.18

sector is no exception. Its geographic location presents a host of economic opportunities provided by Western European markets. Europe also sees Morocco as a potentially stable supplier for its energy needs and has been working closely with the Moroccan government to develop its renewable energy generation capacity. This chapter breaks down the various national and international frameworks guiding Morocco's renewable energy policy that have evolved alongside the country's power sector structures.

Morocco Political Economic History

Morocco sits at the northwestern edge of the African continent, straddling Spain to the north, its Arab neighbors to the east, and sub-Saharan Africa to the south. Globally, Morocco lies at roughly the halfway point between East Asia and North America. Due to the country's continental centrality, it has been exposed to a wide variety of cultural, economic, and political influences and much of its population is multilingual.

France has had an outsize level of influence on current Moroccan political and economic structures. In the wake of independence on March 2, 1956, French colonists left behind a vast infrastructure of roads, railways, irrigated land, and a phosphate export supply chain.[131] Indeed, French resident-general, Hubert Lyautey designated what was to be the capital, Rabat, and the economic center, Casablanca, based on his conception of the American cities of Washington D.C. and New York.[132]

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131 Pennell, C. R. Morocco: From Empire to Independence. Oxford: Oneworld, 2003., p. 163
132 Ibid., p. 149

Following independence, a power struggle among Morocco's divided nationalist factions ensued. This division was exploited by the Moroccan royal establishment, which vied for authority with the various factions, most notably the political party *Istiqlal*.[133] French attempts to displace the royal family only served to bolster their nationalist credentials in the eyes of the masses. King Hassan successfully promulgated a constitution within two years of his ascension cementing his role as military chief and primary executive.

Economically, Hassan worked to develop Morocco's capital-intensive agricultural sector with an eye towards external markets.[134] The country soon became more economically integrated into the international system, but also more vulnerable to its boom and bust cycles. The poor, largely unable to access the wealth generated by Moroccan industries, relied on informal business activities, subsisting on subsidized food products; subsidies for basic goods and services were made possible by American financial aid.[135] Morocco's role as the world's largest phosphate exporter has also helped it to maintain solvency.

During the last decade of his rule before his death in 1999, Hassan undertook significant political and economic reforms.[136] He strengthened the parliament and human rights protocols, moved forward with Euro-Mediterranean economic integration projects, and sold off many state assets – including electricity generation sites (to be discussed in

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133 Ibid., p. 164
134 p. 168-69
135 Ibid., p. 169
136 Ibid., p. 182

much greater detail below). This was done to pave the way for his son, Mohammed VI, to continue on a similar path once he ascended the throne.[137]

Mohammed VI has further strengthened human rights laws and sought to maintain the same general economic outlook as his father – increasing Moroccan import-export activity and remaining economically close to Western Europe and the U.S. The arrival of the Arab Spring in neighboring Tunisia sparked mass protests in the country and a new round of reforms has been initiated; however, they have been decried as insignificant by democratic activists as the King still controls the key levers within the executive branch of government.[138]

The Power Sector in Morocco

Structure and Governance

Unlike Egypt and Abu Dhabi, the Moroccan government has allowed for significant private sector participation in the power sector. Although the primary actor remains the vertically-integrated, state-run l'Office National de l'Electricite (ONE), private companies account for roughly 68% of generation and a large portion of distribution in urban centers; only the national grid remains entirely in ONE's hands.[139][140] All private

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137 Ibid., p. 183

138 BBC. "Morocco vote on King Mohammed's reforms 'corrupt' ." BBC: Africa. 4 July, 2011. http://www.bbc.co.uk/news/world-africa-14011212 (accessed March 30, 2012).

139 ESMAP. "Impact of the Credit Crisis on Investments in the Power Sector: the Case of Morocco ." Energy Sector Management Assistance Program. January 20, 2011. http://www.esmap.org/esmap/sites/esmap.org/files/Esmap%20Vulnerability%20Morocco%2001%2012.pdf (accessed March 12, 2012).

140 Ibid.

producers generating more than 50 MW must enter into contract with ONE; however, producers generating amounts below 50 MW are largely unregulated.[141] ONE offers all IPPs long-term PPAs, which guarantee them grid access for anywhere between 20 and 30 years.

At present, the ONE-controlled national grid receives electricity from four types of producers: IPPs, imports from Spanish and Algerian transnational lines, ONE-owned production, and auto-producers – labeled as such by ONE, auto producers are primarily wind energy sites generating electricity for their own operation as well as nearby industrial facilities and selling the excess to grid.[142] In terms of supply ratios, the breakdown for these four sources is as follows: IPPs supplied the grid with 57% of total electricity transported, ONE with 29.2%, transnational connections with 15.5%, and auto-producers with 0.4%.[143]

Within these four categories, there are several dominant forces that together offer a near-complete characterization of Moroccan electricity production. First, among private producers, Jorf Lasfar Energy Company (JLEC) stands out as supplying nearly 44% of national electricity demand via a 1,356 MW coal plant.[144] Another quarter of electricity production comes from ONE's coal fuel oil and natural gas plants. Spanish imports

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141 REEEP. "Policy DB Details: Morocco." Renewable Energy and Energy Efficiency Partnership. 2010. http://www.reeep.org/index.php?id=9353&special=viewitem&cid=127 (accessed March 30, 2012).
142 Enzili, M. Mustapha. "Wind Energy & Development Dialogue." GIZ. September 19, 2008. http://www.gtz.de/de/dokumente/cder2008-en-country-case-study-morocco.pdf (accessed March 12, 2012).
143 Taqa. "Morocco." Taqa. 2012. http://www.taqa.ae/en/morocco.html (accessed March 11, 2012).
144 Ibid.

account for 15% of total supply and the final 10% come from both public and privately owned renewable generation sources to be outlined more extensively later in this chapter.

Broad energy policies are designed within the Ministry of Energy, Mines, Water and the Environment (MEMWE). Policies are then debated and either accepted or rejected by the Moroccan Parliament.[145] Aside from the MEMWE, all other Moroccan government agencies have a renewable energy focus, these include: Centre de Développement des Energies Renouvelables (CDER), Centre d'Information sur l'Energie Durable et l'Environnement (CIEDE), L'Association Marocaine des Industries Solaires et Eoliennes (AMISOLE), the Centre National pour la Recherche Scientifique et Technique (CNRST), and Unité des Technologies et Economie des Energies Renouvelables (TEER).[146] These agencies are described in greater detail below.

At present, there is no independent regulator overseeing activities or transactions within the electricity market.[147] As such the electricity market for large-scale industrial clients is largely unregulated. The low-voltage residential market faces some regulation from the Directorate of Electricity and Renewable Energies (DEER).[148] DEER is responsible for security of electricity supply as well as the promotion of demand-side management and energy efficiency. Unlike most bodies exercising regulatory functions, DEER is not involved in the tariff-setting process; tariffs are set directly by the Prime

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145 GTZ. "Renewable Energy and Energy Efficiency Promotion in Morocco." GTZ. 2011. http://www.gtz.de/en/weltweit/maghreb-naher-osten/marokko/26777.htm (accessed March 10, 2012).
146 REEEP.
147 Ibid.
148 Ibid.

Minister's office.[149] Both DEER and the MEMWE are allocated funds directly from the national budget.

Financing of Power Projects

Public Sector

Most public sector projects are financed via bilateral donors, multilateral institutions, ECAs, and local banks.[150] ONE is the primary recipient of financing for such projects. Recently, major financiers have included: the Islamic Development Bank, European Investment Bank, and the World Bank.[151] Several large power plants, one of them a hydro station, as well as infrastructure improvements and expansions are being financed via these institutions. Local banks are also willing to assist in the financing public projects, which they see as a good investment.

Private Sector

Private sector projects rely more heavily or private international banks. In the wake of the recent financial crisis, many private international lenders are imposing stricter financing terms on project companies, raising interest rates and the overall cost of financing.[152]

Power Sector Reform

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149 Ibid.
150 ESMAP.
151 Ibid.
152 Ibid.

Power sector reform began in Morocco in earnest in 1994 with the permitting of IPPs to sell electricity to the national grid. In 1997, private distribution companies were permitted to buy electricity from the grid and sell it in large cities.[153] Like Egypt, IPP ownership in Morocco has been fully privatized and follows a scheme to return power generation assets back to the state at some future date.[154]

ONE awarded the first contract for the construction of a privately-owned plant, the Jorf Lasfar IPP, to a joint venture between CMS Energy and ABB Energy Ventures in 1996 following a competitive bidding process.[155] The contract provided for the construction of two coal-fired, steam-based generation units to be erected adjacent to two similar older plants; CMS and ABB were also charged to take over management duties regarding the older plants.

Subsidies

At present, the Prime Minister's Office keeps tariffs slightly lower than competitive rates by subsidizing private generators and distributors. While still substantial, electricity price subsidies in Morocco do not approach those in either Egypt or UAE. In fact, Moroccans pay a higher per kilowatt hour price for electricity than in the U.S. or anywhere else in

153 Ibid.

154 REEEP.

155 World Bank. "Project Finance and Guarantees: Morocco's Jorf Lasfar Power Station." *World Bank Group*. November 1997. http://siteresources.worldbank.org/INTGUARANTEES/Resources/JorfLasfar_PFG_Note.pdf (accessed March 30, 2012).

the MENA region.[156] ONE moved to raise tariffs in the late 1990s and has continued to do so since. The state-run company is currently working with the World Bank to formulate a long-term, sustainable tariff reform plan.[157]

Fuel products, namely oil and gas used for transportation, are heavily subsidized. Morocco paid $3 billion in fuel subsidies in 2010 when oil averaged $85 a barrel.[158] As oil prices climb that number is expected to grow considerably.

Impetus for Power Sector Reform

Morocco has chosen to pursue power sector reform for a variety of reasons centered on the issues of rural electrification and economic efficiency. Morocco's rural population is substantial – 45% of all households; however, the Moroccan electricity grid is highly centralized, designed to service urban centers and industrial sites.[159] Rural households with miniscule demand profiles strain ONE's finances as the utility is forced to erect costly infrastructure over vast distances while facing minimal prospects for financial remittances.

The World Bank and other multilateral financing institutions have played a critical role in Morocco's decision to move ahead with reform efforts, offering the

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156 Khatib, Hisham. "Electricity Subsidies in Arab Countries." Arab Energy Club. May 13, 2010. http://arabenergyclub.com/site/wp-content/uploads/2010/06/ELECTRICITY-SUBSIDIES-IN-ARAB-COUNTRIES.pdf (accessed March 30, 2012).

157 ESMAP.

158 Reuters. "Morocco fuel subsidies to surge to $5 bln-ministry ." Reuters: Africa. January 31, 2011. http://af.reuters.com/article/moroccoNews/idAFLDE70U1ER20110131 (accessed March 30, 2012).

159 UNDP: Special Unit for South-South Cooperation. "Morocco Case Study (Solar Power)." National Council for Public-Private Partnerships. http://www.ncppp.org/undp/morocco.html (accessed March 30, 2012).

Moroccan government a host of incentives to allow private developers to operate in Morocco. In keeping with its stipulations for loans and other multilateral funds, the World Bank and its institutional peers offered Morocco significant financial assistance to support its reform efforts. The bank not only offered loans, but also a partial risk guarantee for private investors; that is if the plant failed to meet economic expectations, the bank would ensure investor losses up to a certain point.[160] The Overseas Private Investment Corporation (OPIC), the Export-Import Bank of the United States, as well as Swiss and Italian Export Credit Agencies also provided loans and risk mitigation services.[161]

These financial assurances were critical in light of Morocco's lack of a country credit rating at the time of reform. Without the assistance of these institutions, it is doubtful that there would be adequate financing available for the construction of the two coal-fired units that signaled Morocco's move toward liberalizing power sector reform. Advisors from the World Bank Group and other multilateral institutions helped Morocco build the necessary legal and technical frameworks that allowed it to engage with the private sector.[162] The actions of these institutions during the Jorf Lasfar project helped establish the parameters for all future private power projects.

Renewable Energy Drivers

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[160] ESMAP
[161] Ibid.
[162] Ibid.

The drivers behind Morocco's move toward renewable energy are more numerous and significant than those of either Abu Dhabi or Egypt. Morocco relies almost exclusively on foreign sources for its primary energy needs. IEA energy balance statistics put local energy production in Morocco at 782 ktoe, while imports stand at 15,678 ktoe; imports total roughly 95% of total energy consumed. The country's reliance on imports mean that price fluctuations can take a particularly severe economic toll.

As of 2009, Iran had been providing roughly a quarter of the country's oil, with the rest being supplied by Saudi Arabia, Russia, and Iraq.[163] In that same year, Mohamed VI severed diplomatic ties with Iran citing that country's intention of spreading Shi'a Islam in Morocco. This move was spurred by Saudi Arabia, which promised to make up Iranian imports at subsidized prices provided the Moroccan king demonizes the tiny Moroccan Shi'a population. Saudi Arabia has made similar promises to other fast growing country economies provided they behave accordingly with Iran; however, its ability to fulfill these promises remains questionable.

Renewable energy figures prominently in the country's Global Rural Electrification Programme (PERG). An elaborate public-private partnership centered on erecting distributed solar energy systems – to be described in greater detail below – has been setup to electrify a large portion of Morocco's most rural areas.[164] This initiative has resulted in greater access to French bilateral aid in the form of soft loans as well as

163 Agencies. "Morocco severs relations with Iran ." Al Jazeera. March 8, 2009. http://www.aljazeera.com/news/africa/2009/03/2009370303221419.html (accessed March 30, 2012).
164 UNDP: Special Unit for South-South Cooperation.

technical assistance for the construction of what could prove to be a long-term solution to Morocco's rural electrification problems.

Morocco's proximity to some of the world's largest electricity markets in Western Europe affords it the potential of becoming a major energy exporter should it prove capable of producing electricity in commercial quantities. Premiums offered by Western European governments for electricity produced via renewables could make this market particularly attractive. Europe, for its part, has shown great interest in the energy resources of its MENA region neighbors situated along the Mediterranean coast. Having sponsored a massive study assessing the potential for energy infrastructure integration across the Mediterranean in 2000, the European Commission has since become the primary sponsor and financier of the Euro-Mediterranean Energy Market Integration Project (MED-EMIP) whose primary aim is to assist in the integration of the regional energy market.[165]

The events of the Arab Spring have cast Morocco's renewable energy initiatives in a more favorable light. Cooperation among North African governments has increased and long-standing trade agreements, such as that between Morocco and Algeria, have been revived in the wake of political upheaval.[166] Morocco seeks to increase its influence in region and boost the bargaining power of the south via the north within the context of the regional energy market.

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165 GTZ. "Euromed Transport Project." GTZ. 2011. http://www.gtz.de/en/weltweit/maghreb-naher-osten/aegypten/11856.htm (accessed March 30, 2012).

166 Coats, Christopher. "Morocco And The Political Potential Of Renewable Energy ." Forbes. February 21, 2012. http://www.forbes.com/sites/christophercoats/2012/02/21/morocco-and-the-political-potential-of-renewable-energy/ (accessed March 30, 2012).

Renewable Energy Developments

Unlike Abu Dhabi's Masdar which oversees the totality of the emirate's renewable energy projects and initiatives, renewable energy developments in Morocco are being directed by a variety of government agencies and international agreements.

Government Agencies

Among the two agencies with renewable energy mandates, CDER is the most significant as well as the oldest. Established in 1982, the agency's focus centers on providing renewable expertise, training renewable energy specialists, and initiating renewable energy pilot projects.[167] CDER is also active in promoting renewable energy in rural areas through the Maisons de l'Energie program; the program works with the assistance of the UNDP to develop small enterprises geared towards meeting the energy needs of rural communities.

A second agency aimed at disseminating information was created in 2000, CIEDE. The operation of CIEDE involves the participation of several stakeholders, including: CDER, the Ministry of Energy, Mining, Water and Environment, the Ministry of the Territory Planning, the United Nations Program for Development / Global Environment Facility (UNDP/GEF) as well as other departments within the National Committee on Climate Change.[168] CIEDE functions as a sort of think-tank drawing on

[167] REEEP.
[168] Ibid.

the knowledge and perspectives of its stakeholders in order to generate substantive renewable energy and energy efficiency data before disseminating it to the Moroccan public.

The third major agency was established in 2009 in order to administer the Moroccan Solar Plan, the Moroccan Solar Energy Agency (MASEN).[169] MASEN is responsible for developing the country's solar capacity. On March 30, 2010, the agency issued its first RfP for the construction of a 500 MW solar plant in Ouarzazate, Morocco.[170]

Professional Organizations

A third organization that operates outside the traditional government structure, but no doubt with its approval, is the L'Association Marocaine des Industries Solaires et Eoliennes (AMISOLE). AMISOLE is a professional organization created in 1987 that represents the interests of renewable energy companies as well as individual stakeholders.[171] Unlike similar professional associations in the U.S., AMISOLE does not focus on legislative lobbying, which is likely done through much more informal and secretive channels. Instead, AMISOLE acts as a networking tool for renewable energy companies; currently, there are 40 member companies.

National Strategies and Frameworks

National Energy Strategy

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169 REEEP.

170 MASEN. "Invitation for Expression of Interest for Ouarzazte Solar Facility." MASEN. March 30, 2010. http://www.masen.org.ma/upload/projets/aai/Pr-43-lang-en-ai-1-12.pdf (accessed March 30, 2012).

171 REEEP.

The most recent national energy strategy was articulated by the MEMEE in 2009. The strategy's broad focus is on security and diversity of supply as a means to reduce import dependency, lower costs, improve access to electricity, and generate positive environmental externalities. The development of renewable energy resources figures prominently as a means to achieve these ends. By 2020, renewable generation facilities are to represent 42% of installed generation capacity in country. The plan calls for an even breakdown in terms of sources between solar, wind, and hydropower, with 14% to come from each source.[172]

Energie Pro

Energie Pro is a program setup by ONE to incentivize private operators to develop wind farms. ONE guarantees private developers access to the national grid and promises to purchase any surplus generated by the developers not used to power their own facilities or those of their clients.[173]

Moroccan Solar Plan

The Moroccan Solar Plan is a solar energy focused sub-strategy of the country's national energy strategy managed by MASEN to develop 2000 MW of solar energy capacity by 2020.

International Frameworks

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172 African Development Bank Group Project Team. "Environmental and Social Impact Assessment." African Development Bank Group. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Ouerzazate%20ESIA%20ex%20sum%20version%20ENG%20Oct%202011%20%282%29.pdf (accessed February 10, 2012).

173 REEEP.

Desertec

Desertec is essentially a conceptual framework emphasizing the energy-rich nature of the earth's desert landscapes. It was initiated under the auspices two globally-oriented think-tanks: the Club of Rome and the German Trans-Mediterranean Renewable Energy Cooperation. Although global in scope, Desertec's focus has been on the Euro-Mediterranean region. The current Desertec proposal aims to create a vast network of renewable energy generation facilities throughout North Africa capable of supporting local needs, while supplying continental Europe with 15% of its electricity.[174]

A joint corporate venture, Dii GmbH, in which the Desertec Foundation is a shareholder, was established in 2009 to promote a strong investment climate in the MENA region for renewables through the development of political, economic, technological and regulatory frameworks.[175] Morocco is playing a central role in Dii GmbH's plan, serving as the site for one of the corporation's reference projects. Dii GmbH is supporting Ouarzazate plant and several other plants still in the design phase as test projects; Dii corporation is the 'private operator' responsible for the construction and operation of the plant.

Current and Planned Renewable Projects

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174 Oliver, Christine. "Desertec: how green energy could power Europe, north Africa and the Middle East ." The Guardian. November 2, 2011. http://www.guardian.co.uk/environment/interactive/2011/nov/02/desertec-green-energy-europe (accessed March 30, 2012).

175 Desertec Foundation. "Organization." Desertec Foundation. http://www.desertec.org/organization/dii-gmbh/ (accessed March 30, 2012).

At present, Morocco's large-scale renewable generation facilities draw from either wind or hydropower sources. The country's four hydropower stations located in Afourer, Al Massira, B. El Ouidane, and Hassan have a total capacity of 424 MW.[176] The first large-scale wind farm – 140 MW capacity – began operation in Melloussa in June 2010.[177] Meanwhile, several smaller wind generation sites operating under ONE's autoproducers program have been feeding into the grid for the past several years, putting the country's total wind capacity at 286 MW.[178]

Among renewable energy systems, distributed solar generation systems currently serve perhaps the largest number of Moroccan residents, estimated at 163,000 through 26,000 solar home energy systems deployed throughout Morocco's rural areas.[179] These systems have been put in place by Tenasol, a French energy company. Meanwhile, ONE subsidized installation costs that Tenasol may offer lower prices to rural consumers.[180]

In terms of planned projects, there is quite a bit on the table for Morocco. Aside from the Desertec driven Ouarzazate solar facility, African Development Bank reports indicate that there are several other large-scale projects for which Morocco has already

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176 Mbendi. "Electrical Power in Morocco." Mbendi Information Services. March 30, 2012. http://www.mbendi.com/indy/powr/af/mo/p0005.htm (accessed March 30, 2012).

177 Tournemille, Harry. "Africa's Largest Wind Farm Opens in Morocco." Energy Boom. June 28, 2010. http://www.energyboom.com/wind/africas-largest-wind-farm-opens-morocco (accessed March 30, 2012).

178 GWEC. "Morocco." Global Wind Energy Council. 2010. http://www.gwec.net/index.php?id=174 (accessed March 30, 2012).

179 SolarServer. "Tenesol, Morocco government to launch program for PV systems on 26,000 homes in rural Morocco; Solar power for 163,000 people ." SolarServer: Online Portal to Solar Energy. November 8, 2011. http://www.solarserver.com/solar-magazine/solar-news/current/2011/kw45/tenesol-morocco-government-to-launch-program-for-pv-systems-on-26000-homes-in-rural-morocco-solar-power-for-163000-people.html (accessed March 30, 2012).

180 UNDP: Special Unit for South-South Cooperation.

devised as investment plan.[181] These projects include two winds farms in Tangiers and in Al Koudia Al Baida with capacities of 150 MW and 300 MW respectively, and a 350 MW hydropower plant in Abeld Moumen, among others.

Power Sector Reform and Renewable Energy

Through its power sector reform efforts, Morocco has divested a large portion of its state-run capacity while allowing private developers to construct new facilities to the extent that the majority of electricity generated in the country comes from privately controlled sources. This has all been done despite the lack of an independent regulator or a strong regulatory framework defining the terms of interaction between public and private entities. ONE has simply contracted with private developers and administered its contract without the oversight of an independent body.

Despite these regulatory deficiencies, private developers have proliferated throughout Morocco and through this a private market has been established and a certain modus operandi entrenched. The fact that such a large number of private operators continue to do business in Morocco boosts investor confidence in the country's power sector. This investor confidence will no doubt aid Morocco in its bid to contract with renewable energy developers.

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181 African Development Bank Group Project Team. "Environmental and Social Impact Assessment." African Development Bank Group. http://www.afdb.org/fileadmin/uploads/afdb/Documents/Environmental-and-Social-Assessments/Ouerzazate%20ESIA%20ex%20sum%20version%20ENG%20Oct%202011%20%282%29.pdf (accessed February 10, 2012).

Yet, Morocco's greatest asset, in terms of the development of both its power sector infrastructure and its renewable energy resources, is its close proximity to and relationship with Western Europe. As a result of these two factors, a host of public and private European and global organizations are eager to assist Moroccan officials in developing the necessary legal and technical frameworks that the Moroccan power sector may operate most efficiently; Morocco is to be a test case for the massive energy integration scheme whereby North African electricity finds its way to European markets.

Conclusion

The Moroccan rationale for pursing renewable energy is perhaps stronger than that of any other country in the MENA region owing to a combination of the absence of domestic fossil fuel supplies, massive wind and solar potential, and proximity to European markets. Morocco's relatively open economy and close political relationship with West have helped to attract a large number of private power operators and made the Moroccan electricity market an attractive one.

The problem with Morocco's renewable energy sector is similar to that of Egypt: an overreliance on foreign aid and other initiatives for the sector's development. European funded studies and favorable financing terms are driving renewable energy in Morocco more than any government institutions – despite the fact that there are three. This is especially true for large-scale generation. Morocco is offering no feed-in tariff for renewable generators and it is unclear how the buying and selling of electricity from more expensive renewable sources is to be justified.

At the small-scale level, Morocco has given the free market free reign, allowing producers of 50MW or less to operate as independent businesses with minimal licensing requirements and made solar energy the solution at the rural level. Yet, Morocco stands to gain considerably if renewables are produces en masse, whether or not its initiatives are supported extensively by Europe or not.

Conclusion: Common Themes, Lessons Learned and Recommendations Regarding Power Sector Structure and Renewable Energy Development

Drivers of Interaction between Power Sector Reform and Renewable Energy

Having looked at the state of renewable energy development and power sector reform in three MENA region countries, this paper will attempt to extract a set of common themes regarding the interaction between renewables and reform. The aim here is to outline key aspects of reform affecting the prospect of renewable energy development domestically. Among the specific features of power sector reform initiatives affecting renewable energy prospects in the MENA region are the level of financial supervision by the local government, engagement with IPPs via the single buyer model, and the level of electricity subsidies.

Financial Supervision by the Local Government

Financial supervision by the local government has been instrumental in incubating the domestic renewable energy sector. In each of the three cases examined, the local government has assumed the role of investor and financial guarantor; however, the level and nature of both the investments made and insurance provided has differed across each country.

Abu Dhabi is acting as the primary investor in its first large-scale concentrated solar power plant.[182] Having secured financing from several domestic and international banks, Masdar has chosen follow its IPP investment model by purchasing a 60% stake in the project, while offering 20% stakes to two separate Spanish and French energy

[182] Carvalho, Stanley. "UAE's Masdar gets $615 mln solar plant financing." Reuters. March 7, 2011. http://www.reuters.com/article/2011/03/07/masdar-financing-idUSLDE72607Q20110307 (accessed March 27, 2012).

companies. As stated previously, this large equity stake is also a type of financial guarantee for Abu Dhabi's investment partners, given the considerable resources it possesses to ensure the project's survival.

Egypt has gone a step further than Abu Dhabi. Through the NREA, it maintains complete ownership of all renewable energy projects. Despite recent moves to allow limited private sector participation on the generation side, Egypt has chosen to forgo allowing private developers to take the lead on the renewables front. The rationale for this decision lies in the NREA's ability to secure more favorable financing terms and even direct financial aid in the form of grants, which do not have to be repaid.

As for Morocco, the picture is slightly more complicated. Like Egypt, the Moroccan equivalent of the NREA, MASEN, will act as the owner and borrower of what is to be the country's first commercial-scale solar plant in Ouarzazate.[183] However, whereas the NREA acted both as primary owner and developer – with onsite NREA personnel building and operating the wind farms at Zafarana – MASEN is soliciting the help of a private developer.

If maximizing the development of renewable energy in the most efficient and economical fashion is the goal, then the issue of what is the right amount of direct financial involvement by the local government must be raised. Addressing this issue strictly from a theoretical standpoint, as these projects have yet to be completed and sourcing for this paper has been limited to publicly available publications, it would seem that a certain level of domestic governmental financial support is necessary for the development of renewables at this stage. Despite the push for greater privatization and

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183 The World Bank. "MA-Ouarzazate Concentrated Solar Power: Financial." *The World Bank* . December 15, 2011. http://web.worldbank.org/external/projects/main?Projectid=P122028&theSitePK=40941&piPK=64290415&pagePK=64283627&menuPK=64282134&Type=Overview (accessed March 27, 2012).

minimal governmental involvement in the power sector, such involvement remains necessary if renewables are to flourish in the MENA region for a variety of reasons.

Conventional power sector projects offer notoriously long periods before achieving full cost recovery. For renewables, this period may be longer or shorter, but as of yet, a standard net present value for large-scale wind and solar projects in developing countries does not truly exist, as the number of projects running long-term is extremely limited. In both Morocco and Egypt, legal and technical frameworks for private investment are underdeveloped. Soliciting full-private ownership in these countries for technologies that have seen limited testing at the commercial level would be difficult. Abu Dhabi's legal energy frameworks are more developed; however, given the cost of renewables compared to conventional sources, attracting private developers, even with a feed-in tariff, could be challenging. At this point, a certain level of financial supervision by the local government remains necessary.

The Single Buyer Model

Each of the three countries examined follows a single buyer model, whereby a government-run transmission network acts as the sole facilitator of transactions between generators and distributors and distributors are unable to contract directly with generators.

Proponents of the single buyer model see it as practically and economically beneficial in several ways. First, they see it as a relatively simple step governments can take along the road to increasing competition that does not require extensive and sophisticated rulemaking and execution strategies. Second, they argue that debt-laden public utilities will be more able to avoid stranded costs – that is infrastructure costs incurred that cannot be recovered due to a change in the regulatory environment; the

single buyer model preserves an important role for the state in power sector and its finances. Lastly, as mentioned previously, the single buyer model shields IPP investors form the risks associated with wholesale electricity markets.

Detractors, specifically policy specialists from the World Bank and its institutional peers, cite that single buyer models where government officials make decisions about when to shift or add to the generation mix are uneconomical as they are driven by politics rather than market forces.[184] In this same vein, they argue that the PPAs offered IPPs can undermine the government's financial position as they lock the government into paying a fixed price for long periods regardless of changing economic conditions; these financial difficulties are felt by the citizenry in its entirety. Essentially, the possibility of corruption and economically inefficient operation increases drastically under the single buyer model.

Clearly, there are both advantages and disadvantages to the single buyer model, but the central issue here is whether or not a state-controlled transmission company or a neutral third party transmission system operator would be better for renewable energy development. The benefits of the single buyer model as contracting with the national energy agenda in mind have already been outlined above. That is a state-owned single buyer can offer prices that make renewable energy economical for developers.

Yet, could not the common set of policy incentives such as tradable renewable energy credits, net metering, renewable portfolio standards, and feed-in tariffs be executed by private generators and distributors? In many ways, this depends on prevailing socio-cultural norms and the general business environment. That is, how likely

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184 Lovei, Laszlo. "The Single Buyer Model: A Dangerous Path toward Competitive Electricity Markets." The World Bank. December 2000. http://rru.worldbank.org/documents/publicpolicyjournal/225Lovei-1211.pdf (accessed March 28, 2012).

is it that business leaders will follow the rules, and how, and to what extent can they get around them. For example, the usefulness of tradable renewable energy tax credits in promoting renewable energy depends on tax structure and enforcement. If taxes are not strictly levied, than tax credits would not be very useful. The same goes for other financial incentives offered by the government.

Therefore, corruption levels and the soundness of existing legal and financial frameworks are key in determining whether a single buyer model or a more fully privatized model would be better for renewables. In Morocco and Egypt, corruption is rampant and legal and financial institutions are underdeveloped by Western standards. In Abu Dhabi, however, corruption levels approach those of the U.S.: Transparency International's 2011 Corruption Perceptions Index put the U.S. at 24 and the UAE at 28 out of a total 183 countries.[185]

Subsidies

Significantly subsidizing the price consumers pay for electricity could drive up demand to the extent that renewable energy becomes less attractive economically. Since renewables are not yet cost competitive with fossil fuels, some level of public financial backing is needed. The economic value of this backing depends on the size of the project. If subsidy driven demand is extremely high and growing, then increasing the share of energy generated by renewable energy will become more costly.

Subsidies in Morocco are minor; however, those in Abu Dhabi and Egypt are significant. In Abu Dhabi, this has lead to considerable waste; its subsidies are in place only to show the benevolence of the state. In Egypt, however, the removal of subsidies

185 Transparency International. "Corruption Perceptions Index 2011." *Transparency International*. 2011. http://cpi.transparency.org/cpi2011/results/ (accessed March 29, 2012).

would make electricity unaffordable to large segments of its population, at least in the short-term.

Conclusion

Over the past two decades, MENA region regimes have sought to streamline and increase the efficiency of their power sectors according to the standards of the World Bank and other multilateral financing institutions, while simultaneously developing domestic renewable energy sources. This paper has attempted to show how these two agendas can both promote and detract from one another. The level of institutional development, corruption, and nature of the relationship between the government and its citizens can significantly affect how privatization-oriented power sector reform initiatives influence renewable energy development.

Massive upheaval has upended many of the existing institutional arrangements in the region, although the UAE has remained largely untouched by this phenomenon. In light of these events, the international community has been strategizing on new ways to engage the region and economic considerations are perpetually at the forefront of most diplomatic plans. Both power sector reform and renewable energy development are part of this economic calculus. Hopefully, this paper has provided some insight into how these two forces interact and how they could be promoted by international institutions in the region on a country by country basis in the future.

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3. —. *About Us: Abu Dhabi Regulation and Supervision Bureau*. 2011. http://www.rsb.gov.ae/En/PrimaryMenu/index.aspx?SubCatMenu_Name=Duties%20in%20Law&SubCatMenu_ID=161&CatMenu_ID=69&PriMenu_ID=79&CatMenu_Name=About%20Us&PriMenu_Name=About%20Us (accessed November 6, 2011).

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Social-Assessments/Ouerzazate%20ESIA%20ex%20sum%20version%20ENG%20Oct%202011%20%282%29.pdf (accessed February 10, 2012).

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